

EXPORT SUPPLY, IMPORT DEMAND AND TRADE POLICY:  
AN ASSESSMENT OF IMPACTS OF THE INTERNATIONAL COFFEE  
AGREEMENT AND THE BEHAVIOR OF EXPORTERS AND  
IMPORTERS IN THE COFFEE MARKET

BY

SAMUEL W. SCOTT

A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL  
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT  
OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

1996

## ACKNOWLEDGEMENTS

I am indebted to the chairman of my supervisory committee, Dr. John J. VanSickle. He is the individual after my parents and immediate family who literally invested in my education. Since the summer of 1989, he accepted the risk in believing in my abilities and has provided guidance, mentoring, encouragement, and direction in all my research at this University, including the preparation of my dissertation. He was always open to my maverick ideas and was willing to steer me to full potential. My committee was selected based on the specific roles that they were able to play in the preparation of this work. I am extremely grateful to Drs. Mark Brown, Robert Emerson, Max Langham and Edward Zabel for their assistance in keeping me in line with standard economic theory, applied principles and econometric computations. I would like to acknowledge suggestions and comments from Dr. Ron Ward at various stages of the research. Their contributions cannot be valued sufficiently; these individuals helped to keep me focused and aided in clarifying and consolidating the research issues. I am very thankful for financial support provided by the Food and Resource Economics Department/IFAS, and directly for the assistantships provided by Dr. VanSickle; this made it much easier to remain in the program.

Finally, I cannot repay my family for their support especially in moments when I felt it would be better to have given up. To Marcia, Sadeeka and Samae sincere thanks for all the support provided. To my friends, too numerous to enumerate here, thanks.

## TABLE OF CONTENTS

	<u>Page</u>
ACKNOWLEDGMENT . . . . .	ii
ABSTRACT . . . . .	vi
CHAPTERS	
1 INTRODUCTION . . . . .	1
Overview of the World Coffee Market, Trade and Pricing Patterns . . . . .	2
Problem Statement . . . . .	5
Hypotheses . . . . .	9
Objectives . . . . .	10
Methodology, Scope and Organization of the Study . . . . .	14
2 BACKGROUND AND ANALYSIS OF THE U.S. COFFEE INDUSTRY . 17	
Major Exporters and Market Shares in the U.S. Coffee Market . . . . .	17
Price Trends and Pricing Patterns in the U.S. Coffee Market . . . . .	18
Marketing Channels and Distribution Systems . . . . .	26
Import Channels . . . . .	28
Marketing Channels . . . . .	30
Market Structure, Concentration and Commercial Entities . . . . .	31
Milestones in the Development of the World Coffee Market and ICO/ICA . . . . .	32
3 LITERATURE REVIEW . . . . .	35
Institutional Framework and International Commodity Agreements . . . . .	35

	Theoretical Framework . . . . .	41
	Market Structure and Export Quotas . . . . .	41
	Market Demand and Structural Changes . . . . .	43
	Previous Studies . . . . .	47
	Descriptive Analyses . . . . .	47
	Empirical Analyses . . . . .	55
	Summary of Previous Coffee Demand Studies in the U.S. . . . .	63
4	SPECIFICATION OF THE MODEL AND EMPIRICAL ESTIMATION . . . . .	65
	Conceptual Framework for Aggregate Supply and Import Demand . . . . .	65
	Modeling Aggregate Export Supply and Import	
	Demand of Coffee Traded . . . . .	70
	General Export Supply and Import Demand Functions . . . . .	71
	Aggregate Supply Equation . . . . .	73
	Aggregate Import Demand Equations for the U.S	
	and Rest-of-the-world . . . . .	73
	Modeling Conditional U.S. Import Demand for Coffee by Type and	
	Importers' Preferences . . . . .	74
	Estimated Equations and Proposed Models . . . . .	78
	Estimation Methods . . . . .	79
	Data . . . . .	83
5	EMPIRICAL RESULTS AND DISCUSSION . . . . .	84
	Empirical Results . . . . .	84
	Aggregate Export Supply and Import Demand for Coffee . . . . .	84
	Test for Evidence of Structural Changes in the Aggregate Model . . . . .	90
	Conditional U.S. Import Demand by Coffee Types . . . . .	91
	Test for Structural Changes in the Disaggregate Model . . . . .	95
	Discussion and Implications . . . . .	98

6	SUMMARY AND CONCLUSIONS . . . . .	106
	Summary . . . . .	106
	Conclusions . . . . .	109
	Suggestions for Further Research . . . . .	111
	REFERENCES . . . . .	113
	BIOGRAPHICAL SKETCH . . . . .	119

Abstract of Dissertation Presented to the Graduate School  
of the University of Florida in Partial Fulfillment of  
Requirements for the Degree of Doctor of Philosophy

EXPORT SUPPLY, IMPORT DEMAND AND TRADE POLICY:  
AN ASSESSMENT OF THE IMPACTS THE INTERNATIONAL COFFEE  
AGREEMENT AND THE BEHAVIOR OF EXPORTERS AND IMPORTERS  
IN THE COFFEE MARKET

By

Samuel W. Scott

December, 1996

Chairman: Dr. John VanSickle  
Major Department: Food and Resource Economics

World demand for coffee has not grown at the same pace as production. The concern for stabilizing prices and export revenues, and reducing over-production over the long term led to the formation of the International Coffee Organization (ICO) and the signing of the first International Coffee Agreement (ICA) in 1962. The purpose of the ICA was to stabilize prices by controlling supply through the use of export quotas. The absence of incentives for cooperating have resulted in ICO member countries not deciding on a new agreement with economic provisions since the spring of 1993. United States, being the major consuming market, presents an interesting case for studying the effects of the export quota system, structural changes and demand in the market given the fact that it withdrew its membership from the ICO in 1993.

The general objective of this study is to assess the impacts of the ICA and the behavior of exporters and importers of coffee given the effects of the ICA export quota system. At the aggregate level the study examines the export supply and U.S. and rest-of-the-world import demand for all coffee traded. The study at the disaggregate level examines the trading of the four types of coffee imported into the U.S. market. These include Colombian Mild, Other Milds, Brazil and Other Arabica, and Robusta.

The results suggest that at the aggregate level, annual inventory levels and domestic production along with spot market price influence export supply decisions. The aggregate demand model was price inelastic and income inelastic. In the disaggregate model, expenditure elasticities were statistically significant for all types of coffee; however, they were elastic for Colombian Mild, Brazil and Other Arabica and for Robusta, but were inelastic for Other Milds. Own price elasticities were statistically significant for Other Milds and Robusta. Cross price elasticities for some (6) combinations were statistically significant, where the premium Arabicas (Colombian Mild and Other Milds) were complements with the lower grade coffee types (Brazil and Other Arabicas, and Robusta). In addition, substitute relationships were seen among the premium coffee types as a group and among lower grade coffee types as a group. Importers preferences were seen for Colombian Mild and Robusta. The results suggest that structural changes have occurred in both the exporting and importing countries.

## CHAPTER 1

### INTRODUCTION

Coffee is grown in the tropics and is considered a perennial shrub. Trees take three to four years to bear and have a productive life of at least 20 to 30 years. Coffee can be harvested twice per year (especially for those plantations located at the equator), but is generally considered a single-harvest crop. When ripe, the berries are picked by hand; however, in Brazil some harvesting is done by machine. The seeds of the berries are removed by a process called "pulping" and are then dried and shipped as "green" coffee beans. Value-added activities including roasting, grinding and blending are performed in importing countries to yield the rich flavored coffee that consumers demand.

Historically, coffee was a plantation crop. Currently, 98 percent of the world's coffee is grown by small farmers and two percent by plantations (Bread for the World, 1990). It is estimated that worldwide coffee production employs some 20 million people. The two main varieties grown and traded are Arabica and Robusta. Arabica is preferred for its flavor and commands a higher market price. It is grown mainly in the highland areas, with the major producing countries being Colombia, Costa Rica, Kenya, Tanzania, Jamaica and Haiti. Large amounts of another type classified as unwashed Arabica are grown in Brazil. Robusta coffee is native to sub-Saharan Africa, but is grown commercially in Latin America and Asia. It grows better in higher temperatures and

lower altitudes. The increase in demand for instant coffee and blends has stimulated rapid expansion in the production of Robustas. Coffee is further classified into four types by the trade industry: 1) Colombian Milds; 2) Other Milds; 3) Brazilian and Other Arabica and; 4) Robustas. Coffee is sold in the wholesale market as green beans, roasted beans, soluble and extracts, and instant coffee.

#### Overview of the World Coffee Market, Trade and Pricing Patterns

Based on value, coffee is the leading primary agricultural commodity in world trade, second in total trade only to petroleum oil. It is a major source of foreign exchange for over 50 countries. For example, Colombian coffee accounts for 50 percent of the legal foreign exchange of that country. It accounts for 95 percent of the foreign exchange for Uganda. Colombia and Brazil are the world's largest coffee producing countries, together accounting for 40 to 50 percent of the world supply. Other large exporting countries include Costa Rica, Kenya, Guatemala, Mexico, Cote d'Ivoire, Indonesia, Uganda, India, Ethiopia and El Salvador.

The total annual supply of green coffee beans ranged from 97 to 155 million bags (1 bag = 60 kgs) over the period 1960 to 1994 (Table 1), with a thirty-five year average of 124 million bags. Exports over the same period ranged from 42 to 80 million bags, with a thirty-five year average of 61 million bags. Domestic stocks have fluctuated widely, ranging from 25 to 86 million bags, with an average of 60 million bags.

As a result of its importance, governments in exporting countries play a critical role in production, trade and marketing policies for coffee. Their roles include provision of credit, quality control, monopoly over milling and marketing, transportation networks,

Table 1. World Supply and Distribution of Coffee and U.S. Imports, 1960 - 1994

Year	Beginning Stocks	Total Production	Total Supply	Total Exports	U.S. Imports	Ending Stocks
	-----thousands of 60 kg bags-----					
1960	59,542	65,341	125,222	42,863	16,428	65,931
1960	65,931	75,878	142,113	46,141	21,068	74,904
1968	74,904	67,781	142,973	46,905	14,773	81,295
1960	81,295	65,295	146,853	51,066	17,769	78,018
1964	78,018	52,612	130,847	41,924	16,743	72,180
1965	72,180	82,108	154,657	50,002	17,769	86,811
1966	86,811	63,298	150,529	48,996	19,317	82,216
1964	82,216	70,688	153,297	55,689	18,106	79,502
1968	79,502	63,214	143,080	53,642	19,680	69,758
1983	69,758	69,623	139,768	55,297	18,931	65,540
1971	65,540	59,202	125,228	51,694	19,408	54,126
1971	54,126	73,598	128,202	58,715	19,075	50,412
1972	50,412	77,060	127,914	61,221	17,502	49,191
1978	49,191	65,717	115,476	60,609	19,045	35,822
1971	35,822	82,651	118,941	55,387	19,204	44,350
1975	44,350	72,970	117,745	59,549	19,212	38,984
1976	38,984	61,162	100,680	56,561	18,452	25,667
1971	25,667	70,724	97,018	48,755	18,828	29,435
1978	29,435	79,018	109,131	64,612	18,482	25,057
1971	25,057	81,906	107,616	62,130	19,963	25,523
1960	25,523	86,174	112,372	59,787	20,463	32,122
1983	32,122	98,152	131,029	65,340	21,056	44,633
1972	44,633	82,074	127,440	65,454	20,620	41,366
1983	41,366	88,975	130,947	68,202	21,080	41,665
1983	41,665	90,508	132,629	72,140	22,968	37,521
1985	37,521	95,837	133,755	70,121	21,386	42,248

Table 1.-- Continue

Year	Beginning Stocks	Total Production	Total Supply	Total Exports	U.S. Imports	Ending Stocks
1986	42,248	79,549	122,059	66,408	22,201	33,450
1987	33,450	103,285	137,031	67,150	23,074	46,807
1986	46,807	94,363	141,585	70,892	22,165	48,528
1987	48,528	97,286	146,072	83,321	21,536	41,215
1990	41,215	100,417	141,984	76,957	21,806	43,221
1991	43,221	104,245	147,815	80,727	19,697	47,391
1992	47,391	93,405	141,566	77,668	21,328	42,570
1993	42,570	93,538	137,140	77,609	23,997	35,534
1994	35,534	94,306	130,900	77,297	22,655	30,948

Note: numbers may not add up due to rounding-off, shrinkage and slippage.  
Source: Foreign Agricultural Service, USDA.

subsidies and taxes. These policies affect the prices received by farmers. It was reported that over 92 percent of the export price went to Kenyan farmers (Bread for the World, 1990), while only 30.3 percent went to Angolan farmers. Langham and Kamajou (1992) estimated that only about 20 percent went to farmers in the Cameroon in the 1980's. In other countries the percentage of the export price going to farmers averaged 58 percent.

In terms of consumption, about 75 percent of the world's coffee is consumed in the importing countries. The major consumers in the coffee market are the U.S., European Community (EC), and Japan. U.S. citizens drink 430 million cups of coffee per day, an average of 1.7 cups per capita. The annual per capita consumption (based on green bean equivalent) in the U.S. slipped from 15 pounds to just under 10 pounds over the period 1976 to 1990 (Bread for the World, 1990). In combination, the U.S.

(the leading consumer), EC and Japan consume over 90 percent of the world's exported coffee. Over the last ten years the consumption in Japan has grown considerably.

By far the issue of most concern between exporting and importing countries is the pricing policies on both sides. It is important to note that prices paid by coffee drinkers in importing countries are substantially above the export price. It is argued that the additional expense for the final stage of coffee processing is incurred by a few major firms. This is estimated to be between 26 percent for instant coffee and 24 percent for roasting of green coffee (Bread for the World, 1990). Concentration has led to an oligopolistic market structure (Karp and Perloff, 1993; Schneider and Gallagher, 1994). Since 1979, the top four processing firms controlled over 65 percent of the U.S. coffee market. In addition, although many of the exporting countries have the capacity to export roasted or instant coffee, they encounter barriers in doing so. The U.S. currently has no import duties on any coffee. The EC, however, levies import duties on processed coffee. Many of the previously centrally-planned economies maintain quotas. By and large, the developing countries have difficulties competing with the market power of the major multi-national importing firms (Schneider and Gallagher, 1994).

#### Problem Statement

Shifts in the world demand for coffee have not kept pace with shifts in supply, while real prices have fallen. As a result, except in periods of occasional production problems (e.g., frost in Brazil in 1975) which lead to increases in prices and subsequent increases in the production of coffee in other producing countries, nominal coffee prices have not shown wide variations. Responding to the 1975 frost, Brazil invested in its

coffee recovery by subsidizing the planting of higher yielding varieties, but competitors had done the same. The result was that by 1981 the market for coffee had excess supply at acceptable prices. From 1981 until 1990, coffee export prices, adjusted for inflation, dropped by over 40 percent. At the same time consumers in importing countries continued paying higher prices for imbibing coffee.

The concern for stabilizing prices and export revenues, and reducing over-production over the long term, led to the formation of the International Coffee Organization (ICO) and the signing of the first International Coffee Agreement (ICA) in 1962 (Clarke and Macrae, 1988). This agreement allowed for membership from both consuming and producing countries in the ICO. The purpose of the ICA was to stabilize prices by controlling supply through the use of export quotas. The ICA operates in two ways. In certain periods the agreement is implemented with no economic provisions, i.e., there is multilateral trade without any export quotas or price controlling mechanisms. In this case it is said to be purely administrative. This was the case over the periods 1975 through 1979 and July, 1986 through 1994. In other periods, the agreement implemented economic provisions that included multilateral trading with export quotas and price controls between producing and consuming countries. This was the original intent of the agreement and occurred over the period 1963 through 1974 and 1980 through 1986. This system met with some success from 1963 through 1968, but has since had severe problems. The quota system was discontinued in 1974 due to the inability of producing and consuming countries to agree on prices and quota levels. Prices increased to unprecedented levels, for example, \$3.79 per kilogram in the U.S.

in 1977 (Akiyama and Varangis, 1989). The World Bank calculated that prices would have risen even higher without the supplies in inventories created by the quota imposed by International Coffee Organization/International Coffee Agreement (ICO/ICA). Declines in prices after 1977 stimulated both the producing and consuming countries into negotiating a new agreement with an export quota as its major tenet. This agreement came into effect in 1980 and kept a floor under world market prices for coffee from 1980 to 1986, after which the quota system was suspended. The suspension was due to the severe drought in Brazil in 1985 which led to reductions in forecasted trade quantities.

Prices continued to decline after this period. These declines led to several attempts to reinstate the quota system. Finally, in the fall of 1993, the U.S. withdrew its membership from the ICO, and 28 producing countries formed the Association of Coffee Producing Countries (ACPC) with an export retention scheme similar to that of the old ICO/ICA. The ICO formed in 1962 had inherent problems with the given ICA export quota system and voluntary export restraint (VER). These included concerns that

- (i) quotas tend to freeze each country's export share at historical levels without allowing for changes in purchasers' preferences;
- (ii) coffee is sold to non-ICO members at large discounts and sometimes resold to ICO importing countries at higher prices;
- (iii) importing countries commitments to producing countries tend to waiver when stocks pile up in exporting countries, resulting in the possibility of lower prices;
- (iv) there was an inflexibility in allocation of quotas among producing countries and among coffee varieties;

- (v) higher prices were paid by member importing countries and lower prices for nonmember importing countries; and
- (vi) higher prices were the primary objective rather than more stable prices.

The absence of incentives for cooperating have resulted in ICO member countries not deciding on a new agreement with economic provisions since the spring of 1993. The agreement reached was an administrative one (i.e., agreement without economic provision). United States, being the major consuming market, presents an interesting case for studying the effect of the export quota system, structural changes and demand in the market given the fact that it has withdrawn its membership from the ICO. Additionally, the annual per capita consumption of coffee has fallen since 1976. The coffee industry has experienced 18 years of the ICA agreement with export quotas and pricing controlling mechanisms, and another 13 years without economic provisions over the period 1964-1994. For the purpose of this study the first case will be called (ICA/BC), the agreement under binding conditions and the latter case is the international coffee agreement under non-binding conditions (ICA/NBC). The periods are as follows:

(1)	1964 - 1974	ICA/BC	11 years
(2)	1975 - 1979	ICA/NBC	5 years
(3)	1980 - 1986	ICA/BC	7 years
(4)	1987 - 1994	ICA/NBC	8 years

#### Hypotheses

There are several problems identified in the new ICA (Vogt, 1990 and Dull, 1992 and 1994). After a series of negotiations and meetings over the period 1988 to March,

1993, a new agreement was completed. This was to become effective October 1, 1994, and run for a five-year period to September 30, 1999. The new agreement did not have economic provisions (e.g., export quotas). However, under Article 30 of the agreement, there are provisions for the ICO Council to examine re-negotiation of the agreement with measures provided to balance the supply and demand for coffee (Dull, 1994).

More importantly, the United States is not a member of the new ICA. In the fall of 1993, the U.S. informed the ICO that it was withdrawing its membership because funding for its continued participation was denied due to lack of congressional support and because business entities in the U.S. coffee industry indicated a reasonably strong preference for a free coffee market. The potential impacts of the International Coffee Agreement and whether the U.S. made the correct decision on the basis of political and economic rationales are empirical questions. While a trade policy variable will not be introduced in the specification of the demand model (as it is in the export supply model), the data will be manipulated such that statistical tests can be done to evaluate the behavior of the market (i.e, evidence of structural changes) in the different trade policy periods. The following testable hypothesis can be established:

- Ho: There is no evidence of structural changes in export supply of coffee given the ICA with or without the economic provisions of the export quota system.
- Ho: There is no evidence of structural changes in the U.S. and rest-of-the-world import demands for coffee given the ICA with or without the economic provisions of the export quota system.

Ho: There is no evidence of structural changes in U.S. import demand for coffee by type given the ICA with or without the economic provisions of the export quota system.

Of particular interest is the third hypothesis. If we fail to reject the null hypothesis, then it can be stated that given trade policy, U.S. importers have treated the market as if it were a free market regime and the ICA was not effective in influencing the coffee market. Consequently, there was no need for the export quota agreement. This would have further implications for the ACPC export retention scheme. On the other hand, if the null hypothesis is rejected, the ICA was effective and therefore from a policy standpoint violated free market conditions for coffee. This runs counter to U.S. trade policy and therefore warrants the U.S. withdrawal from the ICO.

#### Objectives

The general objective of this study is to assess the impacts of the ICA and the behavior of exporters and importers of coffee given the effects of the ICA export quota system. The specific objectives are to:

- (i) estimate the aggregate export supply, and U.S and rest-of-the-world (ROW) import demands for coffee, 1964 - 1994;
- (ii) evaluate structural changes on aggregate export supply, U.S. and rest-of-the-world import demands for coffee under binding and non-binding export quota periods.
- (ii) model U.S. import demand for coffee by type, 1964 - 1994;
- (iii) evaluate structural changes and importers' preferences in the U.S. coffee market,

- (iv) estimate conditional expenditure and price elasticities of U.S. imported coffee by type.

The following rationales underscore the importance of this study. Table 2 shows that the U.S. coffee market was valued at \$3.2 billion in 1993 (Maxwell, 1994). The value declined \$1.7 billion from a high of \$5 billion in 1986 when the industry peaked. The U.S. Department of Commerce reported that the U.S. coffee roasting industry (including coffee shipments, employment, value added, and capital expenditures) was valued at \$6.2 billion in 1989 (Table 3). Annual per capita consumption fell from 15 pounds in 1976 to just under 10 pounds in 1994. It appears at the wholesale trade level that an ICA agreement is no guarantee that prices can be stabilized over a sustained period. This can be seen in the years following the frost and drought in Brazil in 1975 and 1985, respectively. But this has more far reaching effects, particularly as it relates to the structure of the market on the supply side. The fact that Brazil and Columbia account for 40 to 50 percent of the world's production, any major natural disaster or refusal to cooperate on their part will result in nullification of the ICA quota system or coffee export retention scheme and, hence, fluctuations in prices as seen in 1976 and 1986. It has been suggested that the market structure is oligopoly both on the supply and demand sides.<sup>1</sup> There are four major firms in the U.S. that account for 65 percent

---

<sup>1</sup> This is supported by studies including Geer (1971), Andrews (1992), Maxwell (1994), and Schneider and Gallagher (1994). However Karps and Perloff (1994) showed empirically that on the supply side exporting countries behaviors are closer to price-takers than that of market collusion.

Table 2. U.S. Coffee Sales, 1977 - 1993

Year	Regular Coffee		Instant Coffee		Total	
	Million	Million	Million	Million	Million	Million
	pounds	dollars	pounds	dollars	pounds	dollars
1977	909	2,522	141	1,664	981	4,046
1978	883	2,626	183	1,602	1,066	4,228
1979	911	2,543	136	1,588	1,099	4,131
1980	911	2,765	181	1,664	1,092	4,429
1981	931	2,360	174	1,433	1,105	3,793
1982	947	2,514	170	1,436	1,117	3,950
1983	951	2,522	165	1,420	1,116	3,942
1984	942	2,690	158	1,419	1,106	4,109
1985	947	2,780	158	1,420	1,128	4,200
1986	909	3,389	141	1,569	1,050	4,958
1987	942	2,807	136	1,347	1,078	4,154
1988	918	2,610	129	1,253	1,047	3,863
1989	920	2,740	123	1,202	1,043	3,942
1990	925	2,750	119	1,165	1,044	3,915
1991	915	2,500	111	1,050	1,026	3,550
1992	900	2,300	104	1,000	1,004	3,300
1993	890	2,240	99	960	989	3,200

Source: Foreign Agricultural Services, USDA.

Table 3. U.S. Coffee Roasting Industry Shipments, Employment, Value-Added and Capital Expenditure, 1982 and 1987-1989

Items	1982	1987	1988	1989
Roasted coffee value of industry shipments (million dollars)	5,827	6,400.60	6,332.40	6,167.20
Total employment (thousands)	11.1	10.7	10.7	10.5
Payroll (million dollars)	{1}	303	315.6	303.1
Production workers	6.9	6.6	6.7	6.5
Hours worked (millions)	{1}	13.6	12.7	13.5
Payroll (millions)	{1}	170.5	173.4	172.3
Average hourly wages	\$10.47	\$12.54	\$13.65	\$12.76
Non-Production				
Employees (thousands)	{1}	4.1	4	4
Hours worked (millions)	{1}	8.5	8.3	8.3
Payroll (million dollars)	{1}	132.5	142.2	130.8
Average hourly wages	{1}	\$15.54	\$17.09	\$15.72
Value added by manufacture (million dollars)	{1}	2,589.8	2,795.8	2,658.1
(Value added/ (Industry shipments)	{1}	0.4046	0.4415	0.431
Value added per production worker	{1}	\$392,294	\$417,284	\$408,938
Capital expenditures (million dollars)	80.5	155.2	123.2	120.9
Capital expenditures per production worker	{1}	\$23,515	\$18,388	\$18,600

Source: Census of Manufacturers, U.S. Department of Commerce

Note: {1} Not available

of the coffee imported. This indicates a significant level of concentration and market power held by these firms in the U.S. The recent passing of three trade agreements (North American Free Trade Agreement (NAFTA), General Agreement on Tariff and Trade (GATT) and Mercado Comum Do Sol (MERCOSUR)) begs the question of the validity of the ICA export quota system and the role that U.S. importers may play in preferential imports of coffee from Mexico under NAFTA and from other countries, e.g., Brazil and Colombia.

Implicit in the analysis is the question about the economic rationale for imposing an agreement that shifts the market into disequilibrium, thereby violating free trade. At the same time, the major trade agreements are supporting the establishment of free trade zones (Manzella, 1994 and 1995). In light of major trade assumptions and the vast array of empirical trade studies done, the market structure imposed in most studies is that of perfect competition. This study recognizes that this assumption would not be appropriate given the structure of the market on both sides and the export policy that does not satisfy the perfectly competitive pricing and trade patterns. The actions of the ICO through the Cartel and the ICA export quota system have resulted in highly imperfect market conditions in both the ICO producing and importing countries. A model therefore should address these issues or at least show the results under different regimes given the availability of the data.

#### Methodology, Scope and Organization of the Study

An aggregate export supply and demand model is developed to investigate the effect of trade policy in the coffee industry. Then a disaggregate model was used to

assess trade policy and import demand for coffee types in the U.S. In the aggregate model, exporters (producing countries) and importers (U.S. and rest-of-world) were treated as firms operating in a single industry. In the disaggregate model, an evaluation is done for each type of coffee imported by firms in the U.S. The models are static partial equilibrium models which allow for testing of hypotheses. The major assumptions made to facilitate the estimation of the disaggregate model are separability and two stage budgeting to facilitate conditionality of the expenditures on coffee. The literature review includes theoretical, descriptive and empirical studies on commercial trade policy, international commodity agreements, import demand and market structure.

The study examines the International Coffee Organization's international coffee agreements with and without economic provisions (export quota) over the period 1964 - 1994. The study at the disaggregate level examines the trading of the four types of coffee as classified in the market. These include Colombian Mild, Other Mild, Brazil and Other Arabica, and Robusta.

The study is organized in six chapters. Chapter 1 is devoted to an overview of the world coffee market and outlines the problem statement, testable hypotheses, goal and objectives. Chapter 2 presents a general background and market analysis of the U.S. coffee industry. Additionally, a summary of the major milestones in the coffee market and ICO/ICA is included. Chapter 3 provides a review of the literature. This covers commercial trade policy and international commodity agreements, and the theoretical framework on import demand and market structure. In addition, it provides a summary of previous studies on U.S. coffee import demand. Chapter 4 highlights the specification

of the model and estimation procedures. The conceptual framework of the models and the estimation methods and data sources are presented.

Chapter 5 presents the results and discussion and provides insights into the implications of the results. Chapter 6 provides the summary and conclusions of the study along with suggested areas for further research.

## CHAPTER 2

### BACKGROUND AND ANALYSIS OF THE U.S. COFFEE INDUSTRY

A summary discussion about the background of the U.S. coffee industry is presented in this chapter. In general, it covers major exporters and market shares, and pricing trends and patterns at the wholesale and retail levels. A brief account of the marketing channels and distribution systems is provided. Additionally, the market structure, concentration and commercial entities are identified. The major milestones in the development of the world's coffee market and the International Coffee Organization's coffee agreements are highlighted. These areas of information provide the requisite background useful in the development of the analytical model and for interpretation of the results.

#### Major Exporters and Market Shares in the U.S. Coffee Market

The U.S. imports coffee from over 29 countries in five regions of the world. Coffee is imported in the form of green beans (95 percent), solubles (4 percent) and extracts (1 percent). Importers have been able to shift to different sources of supplies, particularly in the case of solubles and extracts, to satisfy market requirements. However, in the case of green beans, which account for the largest volume of imports, Brazil, Columbia, Mexico, Guatemala and El Salvador remain the major exporters to the U.S. U.S. coffee imports accounted for an average of 25 percent of the world's total over the period 1986 to 1993 (Table 4). This has resulted in the U.S. being the largest

destination for world coffee exports. Given the market share of exporters (by value), higher prices are paid for Columbian Milds and Other Milds than for Brazil Arabicas. The majority of U.S. imports of green beans are accounted for by the larger coffee trading companies including merchants and agents. Over the last five years Columbia accounted for 22 percent of U.S. imports, Brazil 21 percent, Mexico 14 percent, Guatemala 8 percent, El Salvador 6 percent and the rest of the supplying countries 30 percent. Table 5 shows in detail the exports of coffee by ICO member countries to all market destinations over the period 1987 to 1993.

#### Price Trends and Pricing Patterns in the US Coffee Market

The role of the International Coffee Organization (ICO) in developing its price policy must be understood to interpret price trends and pricing patterns in the U.S. coffee market. The ICO develops what is known as monthly and annual composite wholesale indicator prices (ACWIP) based on supply region, grades and variety of coffee. These are reported on a cents per pound basis in the New York spot market. As shown in Table 6, highs in current prices were seen in the 1970's with annual average prices ranging from \$0.91 to \$3.47 per pound. Annual average prices then declined to a range of \$2.53 to \$3.45 per pound in the 1980's. Current prices rose 51 percent from 1964 to 1974, 98 percent from 1975 to 1984 and 18 percent from 1985 to 1994. Prices for coffee based on type and using the ACWIP were higher for Brazil and Other Arabica.

There are several tiers of pricing at the wholesale and retail levels. Wholesale prices for U.S. roasted coffee (coffee that is traded and packaged as regular, not gourmet quality) have fallen steadily since the suspension of the ICA in 1989, from \$6.64 per kg

in 1987 to \$5.94 per kg in 1992, with a low of \$4.65 per kg in 1989 (Table 7). The average price for roasted coffee ranged from \$6.34 per kg to \$6.86 per kg over the same period while soluble coffee ranged from \$18.63 per kg to \$20.17. An area of growth in the industry is the specialty coffee market. This supports considerably higher wholesale and retail prices, with specialty coffee commanding \$6 to \$12 per pound at retail. Some coffees, such as the Jamaica Blue Mountain, sell for up to \$25 per pound in retail gourmet shops.<sup>2</sup>

Another factor that influences pricing trends at retail is the buffer stocks held by consuming countries over time. Since the suspension of the ICA quota system in July, 1989, the U.S. coffee buffer stocks have risen. As of March, 1983, the U.S. alone maintained 50 percent of the stock position of all the importing countries of the world, despite accounting for only 25 percent of world consumption. This situation came about as a result of the continued depressed prices for coffee traded in the United States. Prices have remained flat as U.S. roasters and processors draw upon existing stockpiles. Annual marketing margins between import and exfactory prices over the period 1987 - 1992 ranged from \$3.56 to \$3.96 per pound (calculated from Tables 6 and 7). However, some industry analysts have suggested that the slim margin between wholesale

---

<sup>2</sup> Specialty or gourmet coffee generally refers to Arabica beans grown at high altitudes which produces an especially rich aromatic, full bodied brew. This class of coffee commands a premium price that is based on cup quality and availability. A true specialty coffee reflects careful selection of variety and cultivation by the growers, proper processing, grading, storage and shipping by the mill owner and exporter, conscientious roasting, blending and grading by the retail/wholesaler, and marketing, packaging, and presentation by the retailer that maintains optimum freshness and appeal (Schneider and Gallagher, 1994).

Table 4. World Coffee Consumption by Importing Countries, 1986 - 1993

Countries	-----thousands of 60 kg bags-----							
	1986	1991	1988	1986	1986	1991	1992	1993
Europe (EU)								
Belgium/ Luxembourg	1,222	1,187	1,210	1,037	391	600	1,019	786
Denmark	909	918	872	918	865	909	959	831
France	5,067	5,404	5,384	5,290	5,203	5,557	5,614	5,506
Germany	8,707	9,572	9,677	9,881	1,019	10,477	10,771	10,706
Greece	363	500	528	581	631	387	320	96
Ireland	307	94	109	94	119	113	94	98
Italy	4,168	4,308	4,216	4,314	4,859	4,228	4,130	4,930
Netherlands	2,342	2,560	2,447	2,244	2,553	2,486	2,549	2,382
Portugal	282	450	422	448	521	523	581	615
Spain	2,224	2,106	2,342	2,592	2,713	2,652	3,044	2,728
United Kingdom	2,282	2,355	2,331	2,177	2,348	2,342	2,516	2,534
<b>Total EU</b>	<b>27,703</b>	<b>29,447</b>	<b>29,538</b>	<b>29,579</b>	<b>29,282</b>	<b>30,274</b>	<b>31,564</b>	<b>31,212</b>
Austria	977	1,032	1,015	1,337	1,340	1,302	1,212	1,335
Bulgaria	85	85	162	85	102	17	175	0
Cyprus	15	36	49	38	34	47	37	75
Czechoslovakia (former)	522	585	573	586	659	525	472	0
Finland	987	1,036	964	1,058	1,070	965	1,030	1,128
Hungary	746	693	825	443	574	533	588	0

Table 4. -- Continued								
Countries	1989	1987	1988	1989	1990	1997	1992	1993
Norway	704	755	643	711	727	757	736	690
Poland	551	560	620	824	335	243	1,650	0
Romania	120	243	152	157	995	269	841	0
Soviet Union	913	1,215	1,144	2,639	1,080	933	700	0
Sweden	1,624	1,640	1,559	1,640	1,640	1,603	1,634	1,619
Switzerland	711	775	855	995	909	949	995	869
Yugoslavia	897	982	620	841	1,032	638	833	0
Others	81	81	78	86	81	86	86	0
<b>Total Europe</b>	<b>36,643</b>	<b>39,134</b>	<b>39,006</b>	<b>40,868</b>	<b>29,319</b>	<b>39,141</b>	<b>42,057</b>	<b>41,000</b>
Algeria	560	1,849	760	1,738	1,640	1,763	1,064	0
Argentina	546	565	575	600	494	559	662	0
Australia	600	762	648	662	636	846	771	756
Canada	1,735	1,800	1,814	1,822	1,974	2,068	1,916	2,117
Fiji	1	1	1	1	1	1	1	1
Israel	244	233	317	272	272	331	370	0
Japan	4,506	4,963	5,087	5,100	5,236	6,038	5,272	5,889
Korea, North	81	53	222	75	1	1	1	0
Korea, South	349	407	513	695	842	841	842	0
Lebanon	80	130	105	97	164	264	347	0
Malaysia	4	100	323	151	150	172	184	0
Morocco	159	216	296	318	360	334	384	0
New Zealand	109	117	107	115	133	126	132	0
Saudi Arabia	285	385	305	176	259	266	219	0
Singapore	0	0	0	0	72	0	323	129
South Africa	259	245	229	268	276	280	280	0

Countries	1986	1987	1988	1989	1990	1991	1992	1993
United States	17,572	18,197	17,889	18,544	18,974	18,911	17,909	18,287
Others	765	979	1,301	1,294	1,150	1,438	1,649	N.A.
Total	27,887	31,002	30,592	31,833	32,033	33,998	32,334	33,000
Grand Total	64,530	70,136	69,598	72,701	71,352	73,139	74,391	74,000

Source: International Coffee Organization (Unpublished Data).

Table 5. Exports by ICO Exporting Members to all Destinations, 1987 - 1993

Exporting Members	-----in thousand 60 kg bags-----						
	1987	1988	1989	1990	1991	1992	1993
Members entitled to basic quota							
Total Colombian Milds	(11,034)	(11,033)	(11,032)	(11,031)	(11,030)	(11,029)	(11,028)
Colombia	9,111	10,271	13,738	12,212	15,467	14,529	12,692
Kenya	1,292	1,678	2,020	1,649	1,399	1,412	1,412
Tanzania	631	835	948	947	826	1,009	654
Total Other Milds	(14,756)	(19,089)	(21,942)	(17,856)	(18,855)	(20,861)	(19,120)
Costa Rica	1,954	2,157	2,377	2410	2,275	2,662	2,056
Dominican Republic	424	466	561	451	318	443	262
Ecuador	1,192	1,789	1,632	1,528	1,229	1,516	1,941
El Salvador	1,878	1,693	2,591	2,018	2,176	2,991	2,065
Guatemala	2,222	2,870	3,491	2,803	3,288	4,018	3,140
Honduras	1,224	1,464	1,734	1,427	1,800	1,897	1,661

Table 5. -- Continued							
Countries	1987	1988	1989	1990	1991	1992	1993
India	1,387	1,918	2,026	1,511	2,024	1,820	2,205
Mexico	2,549	3,740	4,389	3,526	3,290	3,207	3,297
Nicaragua	566	605	637	420	593	637	587
Papua New Guinea	643	1,282	1,134	776	899	1,027	1,118
Peru	718	1,105	1,370	925	593	764	787
<b>Total Brazil/Other Arabicas</b>	(18,160)	(17,895)	(18,721)	(20,232)	(21,907)	(19,253)	(18,295)
Brazil	16,783	16,494	17,339	19,382	21,238	18,093	16,963
Ethiopia	1,387	1,400	1,382	849	420	1,160	1,332
<b>Total Robustas</b>	(15,838)	(18,487)	(19,355)	(18,287)	(15,739)	(18,279)	(15,301)
Angola	205	420	97	61	18	47	11
Benin	44	18	0	0	0	2	0
Cameroon	1,584	1,493	2,339	1,857	1,738	420	623
Central African Rep.	268	350	187	143	92	156	147
Congo	32	18	4	1	0	1	0
Cote d' Ivoire	3,822	2,885	3,233	4,389	3,857	5,115	2,681
Equatorial Guinea	5	7	7	2	0	2	1
Gabon	27	30	3	2	2	3	1
Indonesia	4,520	6,346	6722	6,378	4,421	5,928	5,014
Madagascar	698	928	925	496	637	420	359
Philippines	440	482	164	122	47	22	133
Togo	281	287	232	164	316	214	153
Uganda	2,318	3,113	2365	2,085	2,010	2,010	2,830
Vietnam	542	868	948	1,146	1,318	2,175	2,642
Zaire	1,052	1,503	2,127	1,479	1,026	995	664

Table 5.-- Continued							
	1987	1988	1989	1990	1991	1990	1993
<b>Sub-total</b>	59,788	68,255	76,725	71,184	74,192	75,343	67,473
<b>Members exempt from basic quota</b>							
<b>Total Arabicas</b>	(2,437)	(2,380)	(2,967)	(2,493)	(2,234)	(2,306)	(1,663)
Bolivia	113	175	150	85	66	54	48
Burundi	490	573	535	655	602	572	426
Cuba	200	202	209	152	188	126	110
Haiti	290	227	191	182	143	171	111
Jamaica	22	13	15	16	20	20	17
Malawi	52	13	125	87	132	137	71
Panama	150	109	182	150	150	150	94
Paraguay	288	175	322	137	46	65	64
Rwanda	492	616	655	601	573	467	188
Venezuela	173	113	288	132	113	175	444
Zambia	7	4	27	27	20	20	28
Zimbabwe	160	111	150	288	194	65	27
<b>Total Robustas</b>	(806)	(1,075)	(1,379)	(636)	(1,379)	(1,168)	(1,351)
Ghana	10	6	11	15	20	42	23
Guinea	89	98	121	54	66	16	27
Liberia	57	80	24	0	0	0	0
Nigeria	13	46	3	2	0	13	9
Sierra Leone	128	79	129	87	74	13	37
Sri Lanka	89	57	3	13	20	7	48
Thailand	446	743	1,160	143	1,183	1,042	1,196
Trinidad & Tobago	1	2	29	12	2	5	9
<b>Sub-total</b>	3,243	3,455	4,446	3,129	3,613	3,474	3,014
<b>Grand Total</b>	63,031	71,710	81,171	74,312	77,805	78,817	70,487

Source: International Coffee Organization (Unpublished Data).

Table 6. Average Quarterly United States Coffee Prices, 1962-1994

----- (Cents per pound)-----					
YEAR	1st Qrt	2nd Qrt	3rd Qrt	4th Qrt	Average
1962	71	71.2	71.1	69.2	70.8
1983	68.7	69.6	62.7	69.5	69.4
1981	78.3	84.4	84.6	84.8	81.6
1965	83.9	83.4	92.1	82.1	83.3
1965	92.1	83.2	84.6	84.8	82.3
1967	75	77.5	76.1	75.8	77.6
1962	75.9	75.6	75.9	76.4	76.4
1965	75.9	75.6	75	80.3	76.5
1970	84.6	93	95.8	95.5	91.1
1974	94.2	92.1	92.1	92.3	93.4
1972	92.1	91.2	99.4	95.1	92.7
1974	99.4	106.1	108.7	108.9	104.1
1974	114.9	125.1	131.5	129.1	122.9
1975	128.9	126.9	142.5	151.3	133.4
1970	155.5	191.6	211.6	238.1	187.3
1972	299.9	389.2	369	352.1	347.2
1972	340.3	n.a.	n.a.	n.a.	332.5
1979	n.a.	n.a.	n.a.	n.a.	n.a.
1981	320	321.3	301.3	277.7	310.6
1981	253.3	246.1	244	249.8	250.4
1962	260.6	256.6	254.2	253.8	256.8
1983	257.3	250.7	252	251.2	253
1974	258.9	287.4	268.6	268.5	263.9
1965	270.9	270.1	268.6	255.9	266.9
1965	380.5	359.3	324.5	327.5	344.9
1962	310.9	287.4	244	272.9	263.9
1988	276.8	287.4	285.5	292.5	284.4

Year	1st Qrt	2nd Qrt	3rd Qrt	4th Qrt	Average
1989	303.8	322.5	303.8	293.7	307.3
1990	289.1	305.4	303	294.1	296.6
1991	289.1	280.5	270.6	262.5	280.9
1992	263.1	265.2	249.2	236.4	257.8
1993	249.2	254.8	241.5	248	247.2
1994	251.5	234.1	245	248.1	244.68

Source: Foreign Agricultural Services, USDA.

Table 7. Average Annual U.S. Wholesale Coffee Exfactory, 1987-1992

Type	------(Per kilogram)-----				
	1987	1988	1989	1990	1992
Ground roast, all pack	\$6.64	\$6.41	\$4.65	\$6.14	\$5.94
Ground roast in one pound can	\$6.49	\$6.34	\$6.74	\$6.86	\$6.53
Soluble	\$18.91	\$19.10	\$20.54	\$20.17	\$18.63

Source: Foreign Agriculture Services, USDA.

and retail prices confirms coffee's use as a loss leader in most stores (Schneider and Gallagher, 1994).

#### Marketing Channels and Distribution Systems

Figure 1 shows the major distribution system for coffee. There are coffee growers in producing countries that are individual producers at the small farmer or

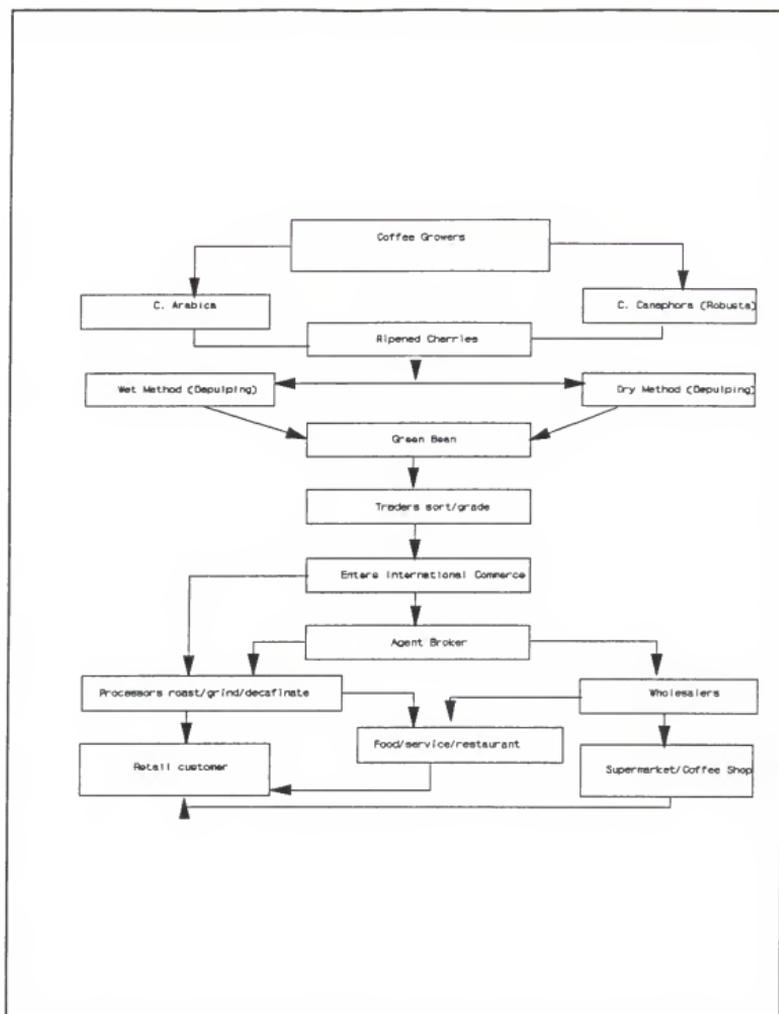


Figure 1. Marketing Channels

Source: Schneider and Gallagher, 1994

plantation level. In addition, small growers are incorporated into producing cooperatives. These farmers and organizations are supported by commodity boards that provide several types of technical assistance. After berries undergo a series of primary value-added activities they enter into international commerce. The first level of institutional operators are the in-country traders. These local traders sell the commodity to agents or brokers who then sell to processors or roasters.

New Orleans is the principal port of entry for coffee entering the U.S. This city accounted for 28 percent of the total green coffee beans imported in 1992. Ports in New York account for 23 percent, Laredo, Texas, 12 percent and San Francisco, 11 percent. No duty is charged on coffee imported into the U.S.; however, under the Tariff Act of 1930 (19 U.S.C. 1319), there is allowance for duty to be charged on imports of coffee into Puerto Rico. The duty rates imposed in Puerto Rico are \$2.50 per pound for green beans and \$3.00 per pound for roasted or ground beans (Schneider and Gallagher, 1994).

#### Import Channels

In the importing countries, coffee is handled by agents, brokers or coffee importers who sell the commodity to processors and roasters. The agent/broker's function is to provide the requisite expertise to buy and sell, ship and finance the coffee before the other buyers take actual possession. Merchants have established connections in the areas of production through worldwide communication networks, which they use to make rapid analyses of the market. The basic function of coffee importers includes buying directly from the agent/brokers. Extensive buying networks are developed and maintained by the larger roasting and packing firms. They in turn import directly

through coffee cooperatives. Import agents and brokers in large trading centers (Hamburg, Germany and London, United Kingdom) also purchase coffee and then re-export around the globe. Some of this is also practiced in New York, where during the winter months when the St. Lawrence River is frozen, agents and brokers re-export and transship coffee to Canada. Also in the U.S., warehoused coffee contracts are traded on a futures market commodity exchange for hedging and speculation. The Coffee, Sugar and Cocoa Exchange (CSCE) in New York City offers 37,500 pound contracts for Arabicas coffee. These contracts call for delivery of washed arabica coffee produced in several Central and South American, Asian and African countries. CSCE graders in New York inspect samples sent from port districts around the world before certifying a coffee lot for delivery. Robusta futures contracts are traded on the London Futures and Option Exchange (London Fox) and the Paris/Le Harve Exchange. Prices on the London Fox are quoted in dollars per metric ton and on the French Exchange in francs per kilogram.

Ninety percent of the coffee imported into the US in 1990 was handled by agents/brokers with the other 10 percent imported by roasters (International Trade Center, UNTAD/GATT, 1992). The bulk (60 percent) of this coffee was sold to roasters. There are about 51 agents and brokers in the U.S. handling the importation of green coffee, with over 50 percent in California and New York (11 and 18, respectively). Operations that characterize themselves as coffee importers total approximately 113, with 35 specialty coffee importers. New York dominates the regular coffee importer category with 48 importers. The Pacific Coast is considered the center of the specialty coffee

industry with 14 importers in California and three in Washington accounting for about 50 percent of the specialty coffee importers (McCabe, 1992).

### Marketing Channels

After coffee is imported and processed it is sold to a wholesaler (Figure 1). The wholesaler then sells to the grocery trade. Wholesale prices are normally set by the large processors. Once changes in the wholesale price quotes are made by one or more of these industry leaders, they are often followed by other processors. In analyzing the relationship between retail and wholesale prices, one should note that although wholesale prices may be stable over certain periods, various types of promotional tie-in sales may result in actual prices varying considerably from month to month.

Because of the different strata of operators in the retailing of coffee, retail prices also reflect various pricing tiers. The final consumers get their coffee through retail grocery companies (supermarkets), institutional outlets, specialty shops, and retailers. There are numerous brands on an average supermarket shelf and the range of retail prices can be large. Choices in brands include regional and private-label brands. The institutional market includes restaurants, hotels, and fast-food outlets, public and private facilities. Regional and local coffee processors, and wholesalers are the main suppliers to these outlets. Coffee shops that specialize in gourmet coffee purchase green beans or special order blends directly from importers and roasters. They generally offer a high-priced product.

### Market Structure, Concentration and Commercial Entities

The 1987 Census of Manufacturers (U.S. Department of Commerce) revealed that there were 111 domestic coffee processing companies primarily engaged in roasting coffee and manufacturing coffee concentrate and extract in powdered, liquid or frozen forms. Between the census period of 1982 and 1987, the number of companies declined by nine percent. Employment also declined by nine percent over this same period from 11,800 to 10,700 (Schneider and Gallagher, 1994).

The coffee processing industry consists of regional roasters and packers, including grocery companies and large national food manufacturers. Many processors are independent roasters who prepare their own brand and products for the supermarket chain stores. The others are national or regional food manufacturers who prepare their company's brand of coffee. In addition, coffee is processed by small food processors and specialty shops.

In terms of concentration in the industry, there are four large firms that account for 66 percent of the value of shipments of roasted coffee. The largest 20 firms account for 90 percent. Concentration in the coffee processing industry is said to increase during periods of high green coffee prices. This is because smaller firms are believed to have more difficulty competing on a product-by-product basis with larger roasters (Andrews, 1992). The growth in micro-roasters (250-500 bags per year) has been tremendous. In 1969, these firms were 20 in number clustered on the west coast between San Francisco and Seattle. In 1989, there were approximately 385 firms classified as micro-roasters. This increase is a result of the increase in demand for specialty coffees.

The structure for the commercial roaster market has not changed much. Maxwell, (1994) reported that this subsector is dominated by a few companies. These include Philip Morris' General Foods with its Maxwell House Brands (33.4 percent) and Proctor and Gamble with its Folger's Brand (31.5 percent), collectively accounting for two-thirds of the ground roasted market in 1992. General Foods and Nestles accounts for 67 percent of the market share for instant and soluble coffee. In general, there are about 171 regular and 126 specialty coffee roasting establishments located throughout the U.S. Their wide distribution suggests that these roasters are located near the market they serve.

#### Milestones in the Development of the World Coffee Market and the ICO/ICA

In October, 1963, the first International Coffee Agreement (ICA) was developed and resulted in the formation of the International Coffee Organization. The reason for its development was to halt the rapid decline in coffee prices and reduce over production. The main market regulatory instruments were the export quota system (EQS) and voluntary export restraints (VER). These instruments were discontinued in 1974 because producing and consuming countries were unable to agree on prices and quota levels.

World coffee prices were at historically low levels in the early 1970's. However, a serious frost in Brazil in 1975 caused prices to reach a new high of \$3.79/kg in 1977. Prices thereafter declined sharply due to persistent over production and increases in stocks. This prompted both the producing and consuming countries to enter into negotiations for a new agreement with EQS as its main trade policy.

From October, 1980, through February, 1986, the EQS was successful in keeping a floor under world market prices. The quota system was suspended in 1986 because of sharp increases in prices due to a severe drought in Brazil in 1985 and low forecasted export quantities in the 1986/87 season. After 1986, prices declined steadily. This led to prolonged discussions in October, 1987, among the ICA members for possible reinstatement of the quota system. Lack of agreement among member nations led to no change occurring.

When in operation, the export quota system was used to determine the global export quota and each exporting member's quota at the beginning of each international coffee year (October to September). Exporting quota-members covered 95 percent of the world's supply. Importing quota-members accounted for between 85 and 90 percent the of world's demand. Depending on the relationship between world prices and the price range set under the agreement, the quotas were adjusted frequently. There was no constraint on members' exports when the EQS was not operative.

Furthermore, there were no restrictions on exports from exporting members to non-ICA importing members (i.e., the non-quota members). New Zealand, the Newly Independent States (NIS) and the formerly centrally planned economies of Eastern Europe and all developing countries except Portugal and Greece are considered as non-quota market countries. In these markets there are no consistent and reliable data on prices. It has been reported that when burdened with large stocks of coffee, exporting ICA countries sell to non-quota countries at discount up to 50 percent of the quota market prices. Another factor is that of barter/counter trade transactions as practiced by these

non-quota members. The ICO has attempted to penalize these discounted sales but has had limited success.

The presence of large stocks without an international agreement has led to coffee prices declining 50 percent since July, 1989. In response, producing countries have sought to cut export taxes, reduce prices to farmers and cut back on inputs, particularly pesticides and fertilizer. A World Bank study (Akiyama and Varangis, 1989) predicted that without the ICA, prices would climb again in 1995, and world coffee export revenues would exceed those expected with the ICA. The study reported that a lack of quotas favors some countries over others and would lower prices by the turn of the century. The study questioned whether these lower export prices would lead to lower coffee prices at retail levels.

ICO/ICA arrived at an administrative agreement in March, 1993. However, in the fall of 1993, the U.S. withdrew its membership from the ICO/ICA. In response, 28 producing countries formed the Association of Coffee Producing Countries (ACPC). The ACPC has instituted an export retention scheme which has shown signs of disintegration due to numerous exemptions that are granted to various members.

In the summer of 1995, the Central American countries Brazil and Colombia agreed to reduce the supply of coffee in order to boost world prices (Caribbean Update, 1995). The reduction is estimated to be between 3.5 and 4 million bags annually. Industry representatives from these countries blamed "market speculators" in New York for the recent plunge in coffee prices, while noting that stocks of coffee in consuming countries have disappeared along with the decline in production.

## CHAPTER 3

### LITERATURE REVIEW

The theoretical arguments for the institutional framework of international commodity agreements are examined in this chapter. In general, the effects of the export quota on market demand, structure and likely structural changes are presented. Several models are presented with their results and limitations. Descriptive and empirical studies are also presented with a view of providing justification and rationale of the approach followed in this study. In addition, a brief summary of previous studies of coffee demand in the U.S. is highlighted. In general, the review of the literature is vital to the conceptual and empirical framework adopted for the estimation procedures used in this study.

#### Institutional Framework and International Commodity Agreements

An analysis of the price, quantity and expenditure effects requires that the institutional and theoretical framework of trade agreements with and without economic provisions be examined. Many primary non-competitive imports from developing countries to developed countries are traded under international commodity agreements. These include cocoa, coffee, bananas, sugar, and most spices. These agreements are basically commercial trade policies that affect the exchange of these commodities. In international trade there are several commercial policies that regulate the flow of goods and services. These include tariffs, quotas, voluntary export restraints (VER), voluntary

import restraints (VIR), currency devaluation and other non-traffic measures including licensing, pythosanitary measures, and commodity agreements. These policies may enhance or impede the flow of goods. They impact import and export prices, the volume of product traded and the allocation of import expenditures among competing regions or countries. In general, these affect producers and consumers surplus both in the exporting and importing countries. In the case of the present study, coffee has been traded under commodity agreements since 1963.

International Commodity Agreements are placed in four classifications (Tweeten, 1992). These are buffer stocks, bilateral agreements, multilateral contracts with or without supply controls, and export cartels. The institutional settings and trade policy for coffee would classify as multilateral contracts.

The ICA was administered by the ICO. The focus was to control country export quotas (but not production controls) in an effort to restrain prices within a price band agreed upon by buyers and sellers that were signatory to the agreements. The mechanism for implementation includes the issuing of stamps to producing countries for their quotas and consuming countries were required to admit only ICO certified coffee with attached stamps.

The International Coffee Organization has administered five International Coffee Agreements since 1963 in an effort to stabilize the price of coffee (Clarke and Macrae, 1988 and Dull, 1994). These agreements were administrative with and without export quotas.

Several attempts have been made since 1902 to develop a coffee agreement (Vogt, 1990). However, it was not until after the 1929 Great Depression that prices declined sharply. The major Latin American producing countries attempted to bond together to protect themselves against these low prices. The Pan-American Coffee Bureau was formed in 1937 with its headquarters in New York. Its mission was to promote the consumption of coffee in the U.S., the largest single market for coffee. In addition, it would try to regulate production and exports in order to stabilize prices. Prices for coffee continued to be depressed and were pushed lower by the outbreak of World War II, coupled with the loss of most markets. This critical situation led to the formation of the Inter-American Coffee Agreement of 1940. This agreement provided for the issuing of export quotas to producing countries that export to the U.S. This became the precursor to what was to come in the post-war period.

After World War II, the development of the United Nations Organization led to the implementation of wide spread services to solve the economic and financial difficulties that primary commodities face in international trade. Coffee did not come immediately under the international umbrella. During this period prices of coffee rose to record levels due to a number of factors including the re-opening of markets and commodity stock piling in producing countries. Production boomed in the 1950's, resulting in the decline of coffee prices. In 1956, the Organization of American States (OAS) sought to draft an International Coffee Agreement, but was not supported by the U.S. Prices continued to decline and an agreement among Mexico, Brazil, Colombia, Costa Rica, Guatemala, and Nicaragua, was implemented in 1957. This agreement was

effective in stopping the further decline in price in 1957. But reports of heavy crops in 1958 resulted in further price decline. Several studies over the period of 1958-1960 suggested the implementation of a wide range of proposals. The proposals included import quotas, buffer stocks and production limits. By 1962, regional groupings were formed with assistance of the colonial powers of France, Belgium, Portugal, and England. They included the Inter-African Coffee Organization (IACO) and the Coffee Federation of the Americas (FEDECAME). Full scale negotiation included the United Nations, and led to the ICO based in London. ICO consisted of 71 coffee exporting and coffee importing countries and other interested organizations. By the November, 1962, deadline, the agreement had been signed by 54 governments, 32 coffee exporting countries accounting for 95 percent of total world exports, and 22 coffee importing countries accounting for 90 percent of world coffee imports.

There have been five agreements since 1963. These agreements were administrative with and without export quotas (Clarke and Macrae, 1988 and Dull, 1994). The 1963 agreement went into force provisionally in July, 1963. The objectives of the agreement were to:

- achieve a reasonable balance between supply and demand on a basis that ensures equitable prices and brings about long-term equilibrium between production and consumption;
- alleviate serious hardships caused by surplus supplies and excess fluctuation in the price of coffee;

- assist in increasing the purchase power of coffee-exporting countries by keeping prices at equitable levels and by increasing consumption and;
- set up a system of export quotas and controls.

Stock policies were developed with the implementation of proper statistical records. The system lasted for ten years until it collapsed in 1973/74.

The second agreement was negotiated in 1968. While the foundation work was completed in 1967, the oversupply of coffee caused downward pressure on prices. Export quotas remained in effect with additional emphasis placed on the need to curb production and to implement diversification measures in producing countries such that supply and demand were brought into equilibrium at acceptable prices. The main objective of this agreement was to maintain and protect the quota and controls systems, reign in long-term oversupply problems and expand the ICO statistical database. The Secretariat was engaged in several rifts. Two major ones were battles over market shares of individual exporting countries and sub-plots that threatened to break up the agreement. These plots were based on the rights of exporting members to give some form of protective treatment to the processing of coffee into soluble (instant) form and its sales abroad.

A third agreement was negotiated in 1976. There was a break in the quota system. Conditions in Brazil precipitated the suspension of the quota system. While the guiding principles of the needs to stabilize prices and guarantee producing countries adequate foreign exchange earnings were valid, the quota system agreement was not implemented. The agreement allowed for the application of the quota when prices were

low and were to be suspended when prices were high. In addition, the agreement segmented the markets into two types, markets where exporting countries operate under quota and non-member markets to which all exports were free of quotas. This was the beginning of instability in the ICO/ICA.

In 1983, the fourth agreement was developed with a view to attempt to re-introduce the quota system. Again members who had expanded production sought to press their claim for larger quotas. But those who had used up stocks to supply the market argued against using stocks as a criterion for determining how quotas were shared. A solution was found under a "status quo" market share arrangement. By 1986, ICO/ICA entered another series of hard negotiations when weather conditions caused supplies in Brazil to be reduced, resulting in higher prices.

In summary, the 1983 ICA failed because of discount sales to non-quota members who in turn re-exported some processed coffee to quota members, and disagreements over distribution of export quotas and over the issue of selectivity. Selectivity applies to the availability of the types and qualities of coffee required by consuming countries.

The fifth and final agreement took over six years to be concluded and came into effect October, 1994 (Dull, 1994). This agreement will run for a five-year period. It does not have economic provisions and the U.S. is not a member. It is an Administrative Agreement. The main features are as follows:

- (i) ensure enhanced international cooperation in connection with world coffee matters;

- (ii) provide a forum for inter-governmental consultations and negotiations when appropriate on coffee matters, to achieve a reasonable balance between world supply and demand on a basis which will assure adequate supplies of coffee at fair prices to consumers and remunerative prices to producers, and long-term equilibrium between production and consumption;
- (iii) facilitate the expansion of international trade in coffee through the collection, analysis and dissemination of statistics and the publication of indicator and other market prices and thereby to enhance transparencies in the world coffee economy;
- (iv) act as a center for the collection, exchange, and publication of economic and technical information on coffee;
- (v) promote studies and surveys in the field of coffee and;
- (vi) encourage and increase the consumption of coffee.

### Theoretical Framework

#### Market Structure and Export Quotas

The structure of the coffee market both in producing and consuming countries depicts that of an oligopolistic market structure (Geer,1971). Conforming to the theoretical assumptions of an oligopolistic structure with implicit conclusions, the industries have been able to form a cartel consisting of both producing and consuming countries (Stigler, 1964). The cartel employs the market pain approach of bargaining

power and supply control to achieve price objectives (Tweeten, 1992). However, cartels are inherently unstable due to the following reasons.

- (1) Any attempt at price fixing without production controls fails because it develops prices initially set so high that they stimulate excess production and result later in a decline in price, or prices are set so low they stimulate shortages which result later in higher prices.
- (2) They lack funds to hold domestic buffer stocks to support the price band.
- (3) There is a lack of trust between the signatories, a lack of discipline among sellers in the domestic countries and a lack of generosity of the buyers in the developed countries.
- (4) Unanticipated market and technological developments work against the agreement.

The result is that commodity agreements have had limited success. In general, the formation of trade cartels have not been first best solutions (Eaton and Grossman, 1986). In addition to the above quantitative restrictions, quotas aid collusion between firms in the producing and consuming countries (Helpman and Krugman, 1989). Problems arise in allocating quotas and maintenance of trade shares. These problems further impair the framework for free trade in that with the trading of a homogenous commodity from supplying countries to one country, a quota or voluntary export restraint (VER) allocating mechanism could intentionally and unintentionally result in price discrimination (Kreinin and Dinopoulos, 1992).

In summary, manifested under the 1963 Agreement with the fixing of a global quota, exports to all countries except the 30 which were designated new markets (without quotas) had to be monitored in order to ensure a balanced market. Rigid control of the market allowed this agreement to hold for ten years. However, a series of natural events (for example, frost in Brazil in 1975) coupled with re-exported quantities for the "non-quota new markets" and political upheaval in African producing countries caused the quota system to collapse. Attempts were made to re-instate the quota system in the 1976 Agreement but the system could not be enforced. This situation still prevails, and the 1993 Agreement is administrative in nature without economic provisions.

#### Market Demand and Structural Changes

In the present study of structural changes in import market demand under various trade policies, structural changes are influenced by forces and conditions either inside or outside the market. These influence the behavior of the firms, thereby affecting the performance of the market. Demand and supply are important market structure attributes affecting these elements (Cochrane, 1957). Several authors have shown that structural factors affect demand for agricultural commodities (Bain, 1942, Cochrane, 1957; Lanzillotti, 1960; and Clodius and Mueller, 1961).

Seven structural factors within the market have been identified as affecting agricultural markets. These are the number of operators in the market, product homogeneity and differentiation, product durability, bulkiness of the product in relationship to its value, ratio of overhead cost to variable costs, adequacy of grade descriptions for buying and selling, and continuity and length of the production process.

Cochrane (1957) showed that as the number of operators within a market decrease the probability of market collusion increases. In general, firms within an industry recognize the advantages of collusion (either formally or tacitly). While collusion has not been empirically shown in the coffee industry, examining the industry on the importing side gives evidence that the number of operators has been decreasing over the years. Schneider and Gallagher (1994) reported that the number of coffee roasting and manufacturing firms declined by nine percent between 1982 and 1992 in the U.S. coffee industry.

Bain (1942) and Lanzillotti (1960) illustrated that other factors, including the number and degree of concentration of buyers and the size distribution of firms, also influence the likelihood of market collusion. Again, while empirical evidence does not bear this out in the U.S. coffee industry, there is evidence of consolidation of firms and the volume of trade shares that they handle. Maxwell (1994) showed that the U.S. ground roast market continues to be dominated by a few companies, with Philip Morris' General Foods with its Maxwell Brand (33.4 percent), and Proctor and Gamble's Folger's Brand (31.5 percent) accounting for nearly two-thirds of the ground roast market in 1992. In 1980 the top four processing firms controlled 65 percent of the coffee market in the U.S. (Bread for the World, 1990). This is likely to increase with the acquisition of smaller firms by the larger companies, e.g., the 1989 acquisitions by Proctor and Gamble of Maryland Club and Butternut for the Winter Park Investment Group (Maxwell, 1994).

Structural factors cannot be considered independently according to Clodius and Muller (1961). They argued that when firms are small in number, they differentiate their product and use non-price competition to stimulate sales instead of collusion. Evidence of this can be seen in coffee advertising expenditures. Industry sources (Butcher and Singer, Inc. and Leading National Advertiser, Inc.<sup>3</sup>) reported that promotional expenditures were \$129 million for the first six months of 1991, five percent over what was spent for the entire year in 1990. The big two, Phillip Morris and Proctor and Gamble, accounted for \$88.3 million of the total, or 68.4 percent. On the producers side, the National Federation of Coffee Growers of Columbia increased its advertising expenditures by over 13.5 percent to \$8.3 million in the first six months of 1991 as compared to the same months in 1990.

Product differentiation in specialty coffee may have also changed the type of competition from price to non-price competition. This would be consistent with the theoretical argument advanced by the above mentioned researchers. Product differentiation is known traditionally to maintain excess profits within an industry by its ability to act as an effective barrier to entry. Non-price competition used by firms to maintain consumer loyalty is evidenced in the industry under study.

Several structural forces external to the coffee industry are also known to have significant effects on the market. Whether these factors pull or push or interact to propel the market is uncertain. The external forces consist of changing consumers' taste and

---

<sup>3</sup> Butcher Singer Inc., and Leading National Advertiser Inc., are two firms that track advertising expenditures in the coffee market (Maxwell, 1994).

preference as reflected in consumption, structural changes in the labor force, increases in population, rising income and standards of living, the frequency of away-from-home consumption, and the awareness of consumers to nutrition and dietary concerns due to increased information and product research.

The National Coffee Association (1993) reported that although per capita daily consumption increased from 1.75 cups in 1991 to 1.87 cups in 1993, the overall daily consumption was well below the peak in the 1960's of three cups per person per day. Changing consumer preferences have accounted for the shift in consumption. Reasons attributed to the decline in coffee consumption in the U.S. range from increased consumption of cold drinks (e.g., soft drinks and other beverages) to lifestyle changes away from structured meals in the home (Schneider and Gallagher, 1994). These factors are enhanced by the increased extraction rate in brewing and higher roasting yields from improved roasting systems.

In terms of the relationship between consumption of coffee and changes in retail prices, consumption was shown not to vary with most changes in retail prices. Empirical research at the retail level showed that coffee demand is inelastic (International Monetary Fund, 1988). However, there are two issues that must be noted, the time horizon of the study and whether there is full price transmission between the wholesale and retail level, particularly backward transmission. Research using data on the industry in the late 1950's into the 1960's showed that coffee demand at the wholesale level was price responsive (Bacha, 1968; Geer, 1971; Adams and Behrman, 1976). A possible

theoretical explanation for this could be the dynamics of maturity of the market over time and the changes in consumers' taste and preferences.

#### Previous Studies

Several production and marketing studies have been conducted on the world's coffee industry. These are country or region specific in some cases but generally worldwide in scope. These studies were conducted looking at the industry from both the demand and supply sides. These studies can be divided into two groups, descriptive analyses and empirical analyses. The earlier studies were descriptive in nature while in later periods, particularly the 70's and later, most of the studies were empirical.

#### Descriptive Analyses

On the supply side, Smith (1974) showed the importance of coffee production in the diversification process of the Colombian economy. After considering historical, political, and socio-anthropological factors, he agreed with the findings of Prebish (1963) and Krause (1965), that in the production and trade of primary products by developing nations, the process presents certain problems. These problems are alleged to be centered on freely competitive trade of these products which are claimed to lead to the development of market conditions unfavorable to the producing countries. The premise for this argument involves the unique supply and demand conditions that characterize the production and marketing of raw material commodities. These conditions can be listed as follows:

- a relatively large number of producers of the primary commodity which makes adjustment to market conditions difficult;

- no single country is likely to control more than a small fraction of the trade in any one commodity;
- weak organizational strengths and institutional capability of the growers' groups to exert control over the output of individual producers.
- the combination of relatively inelastic short-run supply conditions coupled with inelastic demand of the product in short-run resulting in over production and price instability;
- income elasticity of demand for raw material in developing countries less than unity (Prebish, 1963) and;
- technological advances in production of primary products leads to severe long-run over production, surplus accumulation and declining prices and revenue.

In summary he argues that while commodity agreements like the ICA solve the price stability problem somewhat, it creates a problem with surplus production capacity in the major supplying countries. Therefore, commodity agreements in the presence of excess productive capacity leads to misallocation of resources and declines in economic efficiency. The study concludes that producing countries diversify into other enterprises away from coffee and suggest dismantling of the ICA program.

Shelton (1976) focused on the possible effects of the instability in the prices of a primary commodity on economic growth in Brazil. The methodology used by Shelton was a combination of general analysis (exploration of general development theories) and case study approach using coffee as the product. He explained two standard schools of

thought, international trade as a potent engine of economic growth, and the fraction of gross domestic product devoted to international trade tending to decline once a country reaches a fairly industrialized or developed state. He showed that there is no contradiction between the two theories and concluded that one precedes the other. The validation of the results depends on the type of primary products, the degree of underdevelopment, and the domestic, international, political, and economic conditions.

Several studies examined the trend in consumption of coffee in the U.S., the largest single market in the world for coffee. Each winter for the past 33 years the ICO commissioned the winter coffee drinking study. The annual study in the winter of 1986 revealed the heightened dynamism in the U.S. coffee market. It showed that while there is a long-term fall in the consumption of coffee on a per capita basis, the decrease is not as significant in the total amount of coffee consumed due to increases in the overall numbers of coffee drinkers. The study also describes the promotional efforts to change the image of coffee in order for it to appeal to the young and modern life styles. In addition, it suggested conducting promotional activities that will increase the consumption of coffee away from home, e.g., workplace, institutions and vending machines. The study showed the increase in consumption of decaffeinated coffee and changes in methods of preparing coffee.

In 1988, the comprehensive text (Clarke and Macrae, 1988) dealing with the commercial and technological aspects of coffee was published. Several authors contributed to the body of work covering trading patterns, institutional settings for commercial trade and the international standardization of coffee. In general the work

showed the political and economic importance of coffee to several developing economies and the world at large.

The work of Vogt (1990) provided the background for the U.S. Congress and several business interests in the coffee industry to spur the U.S. government to announce its withdrawal of membership from the ICO/International Coffee Agreement in 1993. Vogt suggested that the breakdown of the agreement meant less expensive, but higher quality coffee being available to importers on world markets. He also noted that this situation had allowed for diminished export earnings to growers. He identified the effects of the export quotas as follows. With quotas limiting supplies, member importing nations were more likely to bid against each other for available coffee, driving up prices. The reverse is also true. He concluded that because the current agreement (1989) has no export quota enforcement, no implementing legislation was necessary. However, in the event that there is negotiation of a new agreement with export quota limiting supplies, the U.S. participation would be subject to Senate approval and legislative measures by both Houses of Congress. He suggested that members of Congress had several options. These were as follows.

- (i) Play the laissez-faire role of doing nothing. Any cartel mechanism that supports managed trade would have several opponents who support free trade and believe the marketplace provides the greatest benefit to all when it finds its own equilibrium without government intervention.
- (ii) Pass a supporting or opposing resolution to the President's effort to establish a new ICA.

- (iii) Appoint a panel that would conduct hearings to make clear the advantages and disadvantages of the new ICA. However, this would require additional personnel and new funds which might be a constraint given the climate in Congress to curb deficits.
- (iv) Consider special funds for producing countries' diversification programs.
- (v) Consider preferential tariff treatment. Congress could reward specific countries by levying a tariff/tax on all coffee imports from those countries the U.S. does not support. It should be noted that currently there is no U.S. tariff on imported green coffee.
- (vi) Consider a coffee-for-debt swap. Many of the exporting countries have heavy external debts and are combating drugs. Swapping coffee for debt might be one way the U.S. can assist these countries.
- (vii) Require stockpiling of coffee. Congress could direct the Administration to purchase and stockpile coffee from countries the U.S. wants to assist. This will cause the price of coffee to increase in the short-run and because coffee is a non-competitive import, this option would not come up against resistance from U.S. producers. The downside of this decision would be the biological characteristics of the commodity. After six months coffee tends to lose its flavor. In addition, purchases would increase the U.S. budget which has other negative implications.
- (viii) Consider storage facility construction assistance. U.S. funds could be used to build storage facilities in producing countries. This would allow

for timely release of supplies into the world market. However, apart from the loss in quality if stored too long, there is the additional problem of where the net effect of increasing world prices would work against U.S. importers and roasters.

Maxwell, (1994) analyzed the coffee market by looking at consumption, recognizing that per capita consumption in 1993 was stagnant and had fallen slightly despite favorable media attentions and the entrance of "Baby Boomers" into their middle years when coffee drinking tends to be highest. He indicated certain significant changes in the industry. While the consumption of decaffeinated and soluble coffee has declined, regular coffee has become the favorite type of coffee again for most consumers. Specialty coffee shops, gourmet food stores, "shopper club" stores, and discount stores have gained popularity as the major shopping sources of regular coffee. Particularly in the Northwestern U.S., espresso bars, carts, and coffee bars have become common place. These stores are gaining market shares and show increasing profitability by serving a variety of fancy coffees. The study also outlines institutional changes that are likely to impact the market over the long-run. Because of the series of failures to negotiate a new ICA, a group of 28 producing countries formed the Association of Coffee Producing Countries (ACPC) in 1993. The action caused the market price of coffee to show some increase. This was achieved by the group implementing a retention scheme. Another cartel can be seen in this formation. In the fall of 1993, the U.S. informed the ICO that it would not agree to a one-year extension of the ICA and would no longer be a member of the ICO. This action did result in a serious economic decline

in export revenues for producing countries due to lower prices, but caused an increase in higher quality coffee at lower prices to U.S. consumers.

Schneider and Gallagher (1994) presented a comprehensive overview of the coffee industry as it relates to the coffee market in the U.S. On the supply side they summarized some of the political and economic factors that affect the top supplying regions including Brazil, Columbia, Central America, Africa, Asia, and Oceania. After 1990 the government in Brazil had relaxed its control on the industry, allowing farmers and cooperatives to negotiate free market sales directly with exporters and their agents. However, the government still retained control over export prices by closely monitoring the system of Central Bank registrations. Due to its influence Brazil plays a prominent role in the supply, price, and allocation of export quotas under ICA. Current and future trends in the world market for coffee will be influenced by Brazil's output because it supplies over 30 percent of the world's total supply.

In Africa, supplies are hampered by political upheavals. Because of the high quality arabic produced by some countries (e.g., Colombia, Kenya and Tanzania), these countries are in a better marketing position than others. However, switching of consumer preferences to South American Arabicas could cause declining market shares for several African countries. Production in general continues to decline due to low international prices and in some countries (e.g., Cameroon), implicit taxation by government policy.

In Asia and the Oceania regions, Indonesia emerges as the world's third leading supplier of coffee behind Brazil and Colombia. In general, it is the largest producer of

Robusta. Production in the region has increased due to an increased demand for coffee in Japan. Most plantings have included a higher percentage of Arabica. The roles of the government consist of collection of taxes, administration of quality controls, and the monitoring of foreign exchange receipts.

In addressing the world market situation and the future of the ICA, Schneider and Gallagher reported that failures of the ICA caused hardship on certain producing countries. Additionally, as returns fall the quantity of inputs used decline, which adversely affects supplies and quality. This condition is said to be detrimental to both the producing and consuming countries.

Dull (1994) focused on the failure of the ICA and the role of the newly formed Association of Coffee Producing Countries (ACPC). In implementing its retention scheme in October, 1993, it required, depending on market prices and production levels, that the 29 members withhold up to 29 percent of their exportable production. ACPC based its retention scheme on target price ranges of the 20-day moving average of the ICO composite price for Other Milds and Robustas. Members whose production and annual exports are less than 400,000 bags (bag = 60 kgs.) were exempted from the retention scheme. ACPC monitors the market and once price exceeds the target level, it allows the other countries to release retained coffee. In the first six-month report released by the ACPC, over ten members were exempted from the scheme because of the smallness in the size of their crops. Indonesia, Ethiopia and Ecuador indicated their willingness to initiate the retention plan given their 1994 harvest cycles. Burundi and

Rwanda requested exemption because of the civil wars, while Kenya and Tanzania asked for special treatment because their marketing was based on an auction system.

### Empirical Analyses

Many empirical studies have been conducted to explain the coffee market. Most have been modeled assuming a perfectly competitive market structure. Over the last decade attempts have been made to model the coffee market under imperfect market structure. The following presents a summary of some of the empirical research that has been applied to the coffee industry after the initiation of the ICO/ICA in 1963.

Bacha (1968) constructed a policy-oriented econometric model for the international coffee market. He evaluated feasible policy alternatives using the Brazilian Coffee Market as the case study. Using data from 1954 up to pre-ICA (1963) and then five years after the Agreement, he estimated the following model. It consisted of twenty-three stochastic equations and twelve identities or market equilibrium conditions to evaluate supply and demand sectors. The model allowed for the incorporation of three main types of coffee (Brazil, Milds, and Robusta). It was further extended to execute policy simulation experiments using the reduced form of the model. Certain conditional conclusions were drawn.

- (a) Brazil faces a price-elastic demand function for its coffee, counter to results from other studies and the country stands to lose revenue by decreasing its price.

- (b) The income elasticity of demand for Brazilian coffee is smaller than that for others types of coffee. Independent of Brazil's pricing policy, this will result in a continuous reduction in Brazil's market share.
- (c) The exportation of Brazil's market-quota without any reduction of the current price of its coffee is contingent upon reducing the quota of its competitors at the bargaining table of the ICO or a change in the pricing rules of the ICA.

Vanderslice (1971) investigated the success of the ICO/ICA in dealing with the problem of coffee production by using an oligopoly framework where the coffee industry is dominated by governmental cartels. It confirmed the two conditions that are necessary for an oligopoly to form under government cartelization. These were: (a) relatively inelastic long-run demand with respect to price movements and; (b) the existence of market conditions that prevent the entry of more than a few producers. The model was able to show that in the transfer of resources, as occurred with the ICA, the Agreement caused various inefficiencies resulting in losses in both producers' and consumers' surpluses due to the artificially high price of the product. In addition, the misallocation among producers due to the allocation by quota instead of marginal cost was recognized. The conclusion was that although the ICA had several problems, price increases were stimulated by oligopolistic forces that existed even before the establishment of the ICO/ICA. The study recommended the following in order to avoid the pitfalls of such commodity agreements:

- (i) imposition of a tax on the commodity;

- (ii) the establishment of a diversification fund and;
- (iii) consuming countries should try to understand and know how badly the market is functioning, and what oligopoly tactics they are confronted with before entering into any commodity agreement.

Pollock (1971) developed a price dependent world model in an attempt to evaluate the world price and production effects which resulted from the operation of the ICA from 1963 to 1968. The model was estimated with and without the ICA with statistical verification. The model covered a sixteen-year period (1953-1968) using 20 consuming countries that accounted for 90 percent of world's coffee imports. A summary of the results is as follows.

- (1) Exported quantities exceeded quotas during the 1964-68 period under the ICA.
- (2) The ICA did not achieve a set of prices which was significantly different from the prices achieved prior to the ICA, i.e., the old one-year agreements prior to 1963.
- (3) The pattern of foreign exchange earnings for exporting countries was not significantly different in either period.

The reason offered for the above results was that the ICA quota system was not strictly followed. The study was unable to empirically test production effects, because the ICA had not explicitly instituted any production controls on producing member countries.

Adams and Behrman (1976) explored the performance of relatively simple standardized models in an attempt to capture the major features of international commodity markets. The general specifications used in their treatment of the coffee industry was to model : (a) supply relations for the developed market economies, the developing economies, and the centrally planned economies; (b) demand for the same three groups; (c) world inventory and; (d) world price determination. The study covered the period 1956-73. The results on the supply side showed that there was no evidence of a short-run price response, while there was evidence of long-run price response with a gestation period of six or seven years.

The long run elasticities of demand were inelastic for developed and developing economies, but were highly elastic for the centrally planned economies. The latter was attributed to the non-price allocation mechanism and conservation of foreign exchange in the centrally planned economies. The estimated relationship for deflated coffee prices showed that the demand for coffee stocks was quite responsive with respect to deflated prices, i.e., it was highly elastic. Fluctuations in supply and demand were absorbed in inventory charges relative to price movements. Using dummy variables to estimate the effects of ICA on price, it was shown that while the effect was significant, it was diminishing around the mid-1960's and into the 1970's.

Ford (1977) developed world models to evaluate the supply, trade and demand situation. An asymmetric adjustment model was used for Brazilian supply where coffee trees were treated as a capital stock variable dependent on real coffee prices received by the farmers, influence of the Brazilian diversification programs during the 1960's, the

impact of the severe frost in Southern Brazil, the gestation period between the time new trees were planted and when the first mature harvest was obtained and coffee yield per unit area of mature trees.

Standard economic theory was used to model demand and trade. It was further extended to include changes in inventories. In the determination of spot market prices three factors tend to influence these prices. These factors were Brazil's supply dominance, the ICA and differences in prices for different grades of coffee.

Simultaneous estimations were used with a series of validation tests. The tests showed that the production sector was the best part of the model. Stocks of trees respond in an asymmetric way to changes in prices and are responsive to the diversification program and the severe frost. The validation tests showed that the poorest component of the system was the demand and trade sectors. The demand and trade relationships were most developed for the U.S., less developed for Europe and almost non-existent for the rest of the world. The response showed that demand for regular coffee was inelastic with respect to its own price, real income, and substitutes (soluble coffee and tea). While the validation tests showed the price sector performed better than the trade and demand sectors, the results showed that spot market prices were responsive to changes in levels of exportable production and inventories as well as the ICA.

Layman (1979) presented one of the most extensive models for analyzing the impacts of export controls since the implementation of the ICA. This study developed both partial and general equilibrium models to evaluate the theoretical effects of imposing

quantitative and non-quantitative restraints on exports. The model application was geared toward the Brazilian coffee industry.

His analysis demonstrated that with the general equilibrium model, symmetry prevails regardless of whether the controls were placed on the exported or imported good. It also supported the known position that when a country is a significant supplier of a strategic commodity, export controls are preferred.

Three different types of export controls were tested in the case of the partial equilibrium model. These were an export tax, a tax on exportable production and an export quota. The evaluation tested the impact of these controls on international price, trade flows, domestic price, production, and consumption. The results showed that under small country assumptions an export tax and a quota had similar effects, while the effects of a tax on exportable production were slightly different. Under the large country assumption, it was shown that although the magnitudes were different, market structure does not affect the direction of the effects of imposing different types of controls. Both export taxes and quotas have different effects from a tax on the production of exports.

The results for the application using data from 1961-75 for the world and Brazil coffee industries confirmed that low price elasticities of demand and supply for coffee existed as reported in previous studies. Combining the model within a monopolist structure and imposing an export tax showed that over the period 1968-75, Brazil coffee prices and quantities traded were influenced to a limited degree by the tax policies imposed.

Hyuha (1982) developed single-equation models to evaluate the world's demand for coffee with particular reference to supply sources from producing countries in East Africa. The emphasis was on the U.S. coffee market. The results showed that coffee had an inelastic own-price elasticity of demand. The claim that small countries could continue to supply as much as possible without affecting their revenue flow was not supported. Evidence of this was substantiated where the own-price elasticity was less than unity. In addition, he found that coffee was not only a normal good, it tended to be income elastic. He supported supply management and cooperation under the ICA.

Akiyama and Duncan (1982) developed an econometric model of the world coffee economy to evaluate the medium to long-term market outlook for coffee. The model was constructed with nineteen equations for supply and demand.

In summary, their results showed a dismal outlook for growth in consumption and price of coffee, with stagnating demand in the U.S. Future demand in Western Europe was highly dependent on income growth, and pressure from substitutes (e.g., soft drinks and fruit juices). Prices and the rate of growth of production were forecasted to decline during the middle of the 1990's. The simulation models showed price and income decline because of increases in production at a faster rate than growth in demand from population and income increases.

Short run supply was highly inelastic. Long-run price elasticities were inelastic except for Brazil and Indonesia. Price elasticities of demand (short-run and long-run) were inelastic for all consuming countries. Income elasticities for Japan and Middle Europe were elastic, but were inelastic for Western Europe and the United States.

Akiyama and Varangis (1989) modeled the impact of the ICA/export quota system on the world's coffee market. The model differed from the earlier work by solving for world prices that equilibrate export supply and import demand in the quota market. In the earlier model price was solved as function of stocks and world demand. Additionally, the model incorporated the vintage capital approach to the specification of supply response. The results showed that the quota system had a stabilizing effect on world coffee prices in the period 1981-85 period. However, the quota reduced export revenues (in real terms) for all but the larger producing countries, Brazil and Colombia. These countries are said to gain from the scheme because they face small or even zero marginal export revenue for increased exports due to their large market shares.

Vogelvang (1992) developed hypotheses tests to evaluate the long run relationship between the four indicator (spot) prices of coffee. The price formation of coffee was investigated and the univariate properties of coffee were checked. Co-integration tests were performed. The tests showed that certain vectors were statistically significant, Colombian Mild and Other Mild, Robusta with Other Mild, and Robusta with Colombian Mild. The other relationships were rejected statistically. Of interest is the relationship of Other Mild and Brazil Arabica, although these are Arabicas, the relationship was not statistically significant. The reason offered is that Other Mild prices are more reflective of free-market conditions than the Brazilian Arabica, because of special deals Brazil negotiates with leading coffee importers.

Karp and Perloff (1993) examined the oligopolistic structure of the coffee market on the supply side. A linear-quadratic, dynamic feedback oligopoly model was used to

estimate the degree of competitiveness and the adjustment paths of the two largest coffee exporters, Brazil and Colombia. This model was also compared to a standard static oligopoly model and the open-loop model. The results showed that Brazil and Colombia compete vigorously with each other in supplying the market. In addition, both countries behavior was closer to price-takers than that of market collusion.

Bohman et.al (1996) investigated rent seeking activities and the effect of the ICA export quotas. A theoretical model was used to show how the imposition of the ICA quotas facilitates the creation of potential rents within coffee importing countries, and how competition for these rents may affect coffee allocation, income distribution and welfare in Indonesia. It was concluded that although benefits may accrue to government treasuries and coffee farmers, rent seeking losses can outweigh the gains from the higher prices as a result of the ICA quotas. The empirical evidence supports the argument that there is little justification for higher prices charged to consumers in the member importing countries as compared with the worsening effects of directly unproductive activities (DUP) on the distribution of income in the member exporting countries.

#### Summary of Previous Coffee Demand Studies in the U.S.

There have been few empirical studies addressing demand for coffee in the U.S. The first studies after the Second World War were those of Daly (1958) and U.S. Department of Commerce (1961). These studies used time series data and revealed that the income elasticity of demand for coffee in the U.S. was positive but was slightly lower than it had been prior to WW II. The reasons offered included distribution of

population, the increase in consumption of instant coffee versus regular coffee and the increased efficiency in the extraction rate of instant coffee.

Contradictory results were seen in the studies conducted later by Iovasy (1967) and Timms (1973). The results showed that the income elasticity of demand for coffee was negative. This was attributed to saturation of demand for the commodity, and a shift in tastes and preference.

Parikh (1973) established the hypothesis that total annual coffee consumption is a stable function of income and that variation of imports were due mostly to variation in inventory of these products. Demand was shown to be inelastic.

Gray (1971) showed that the own-price and income variables were limited in explaining the downward trend in the consumption of instant coffee. The focus was on varieties of coffee traded (Robusta, Arabicas, and Brazil's Arabica). Very high values of elasticities were seen for income and own-price elasticities of demand.

These studies were done for time horizons in the 1960's and 1970's. The 1988 study published by the International Monetary Fund showed that both short run and long run price elasticities of demand were inelastic, indicating that coffee demand is not very responsive to price changes.

## CHAPTER 4

### SPECIFICATION OF THE MODEL AND EMPIRICAL ESTIMATION

The conceptual framework and analytical model of the study are presented in this chapter. The assumptions within the conceptual framework are discussed. The analytical model is presented in two parts. First, to satisfy equilibrium conditions, aggregate export supply and demand are specified in the framework of optimization of industry surplus, i.e., optimizing consumer and producer surpluses within the industry as a whole. Second, the conditional U.S. import demand for coffee by type is specified. Finally, the estimation methods are presented.

#### Conceptual Framework for Aggregate Supply and Import Demand

In modeling the demand for coffee the assumption of a unidirectional cause and effect relationship between price and quantity cannot sufficiently explain the true nature of the market. In fact, the very nature of the policies affecting coffee implies that there is a simultaneous relationship in the export supply and import demand for coffee.

The logical schematics of the problem can be represented in figure 2. Assume a stable demand  $DD$ , with the imposition of a global export quota in different periods resulting in supply curves  $S_0$  and  $S_1$ . The equilibrium prices and quantities are  $p_0$ ,  $q_0$ ,  $p_1$ , and  $q_1$  in the two periods. In a non-quota regime the supply curve would lie to the right of the quota imposed supply curves in each period,  $S'_0$  to  $S'_1$ . Equilibrium prices

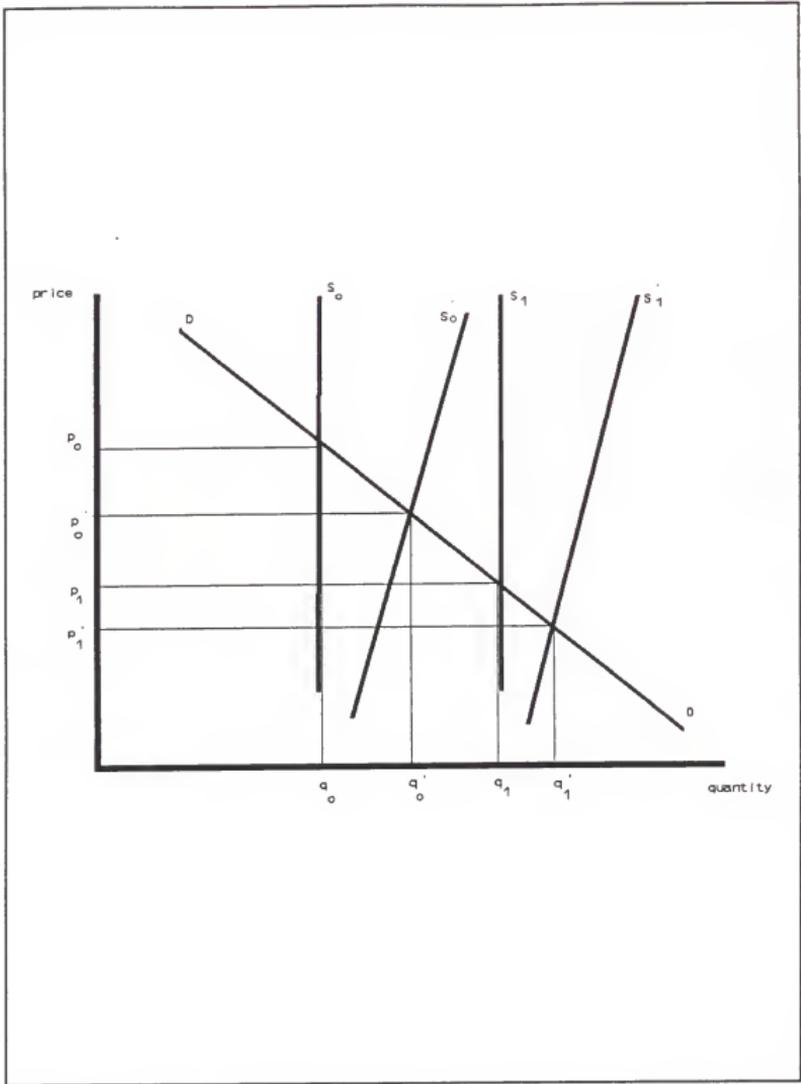


Figure 2. Interdependence of Price, Quantity and Quota Effects

$p_0'$  and  $p_1'$  would be lower in each period than a quota derived equilibrium, with larger equilibrium quantities  $q_0'$  and  $q_1'$ .

Demand and supply can be represented by the following behavioral equations with an identity for equilibrium.

$$q_{dt} = \alpha_0 + \alpha_1 p_t + e_{1t} \quad (1)$$

$$q_{st} = \beta_0 + \beta_1 p_t + e_{2t} \quad (2)$$

$$q_{dt} = q_{st} \quad (3)$$

where  $q_{dt}$  is quantity demanded in time period  $t$ ,  $q_{st}$  is quantity supplied in period  $t$ , and  $p_t$  is the price in period  $t$ . It is assumed that  $\alpha_1$  is less than 0 and  $\beta_1$  is assumed to be greater than 0. If for some reason  $e_{2t}$  in (2) is correlated to changes in other factors affecting  $q_{st}$  (e.g., weather, policy), the supply curve will shift outward or inward depending on whether  $e_{2t}$  is positive or negative. As shown in figure 2, a shift in the supply curve affects both  $p$  and  $q$ . The same is also true for  $e_{1t}$ , a shift in the demand curve. As a result of these changes there is simultaneous dependence between quantity and price. The assumption of no correlation between the predetermined variables and the disturbance term is therefore violated given the assumption made for the classical linear regression model (Greene, 1990).

Recognizing the problem of simultaneity, there are other concerns that the model must also address. These relate to the international trade framework in which coffee is traded (especially U.S. import demand by type). The trade policy framework can be developed for coffee as represented in figure 3.

Assuming exporting countries operate under perfect competition and non-binding quota conditions the equilibrium price and quantity are  $p^*$  and  $q^*$ . The excess supply curve (ES) in the trade sector is the horizontal difference between the domestic supply and demand curves when supply exceeds demand. The corresponding demand curve in the trade sector is the sum of the demand curves for the U.S. and the rest-of-the-world. The U.S. and ROW do not have supply curves because they are not involved in the primary production of coffee. The equilibrium price and quantity with the non-binding quota is  $P_w$  and  $Q_t$  respectively, where  $P_w$  is the international price that importers (in the U.S. and ROW) will have to pay to purchase the quantity  $Q_t$ . By imposing a quota of  $Q_q$ , the equilibrium price is  $P_{wq}$  which is the price that U.S. and ROW importers would pay to buy the quota quantity  $Q_q$ .  $P_{wq}$  is greater than  $p_w$ , i.e., the equilibrium price importers face when the quota is binding is greater than the equilibrium price when the quota is non-binding.

International trade will yield one price (net of transportation costs and duties) where world imports must be equal to the world exports. All markets must clear and equilibrium is where the excess demand curve intersects the excess supply curve.

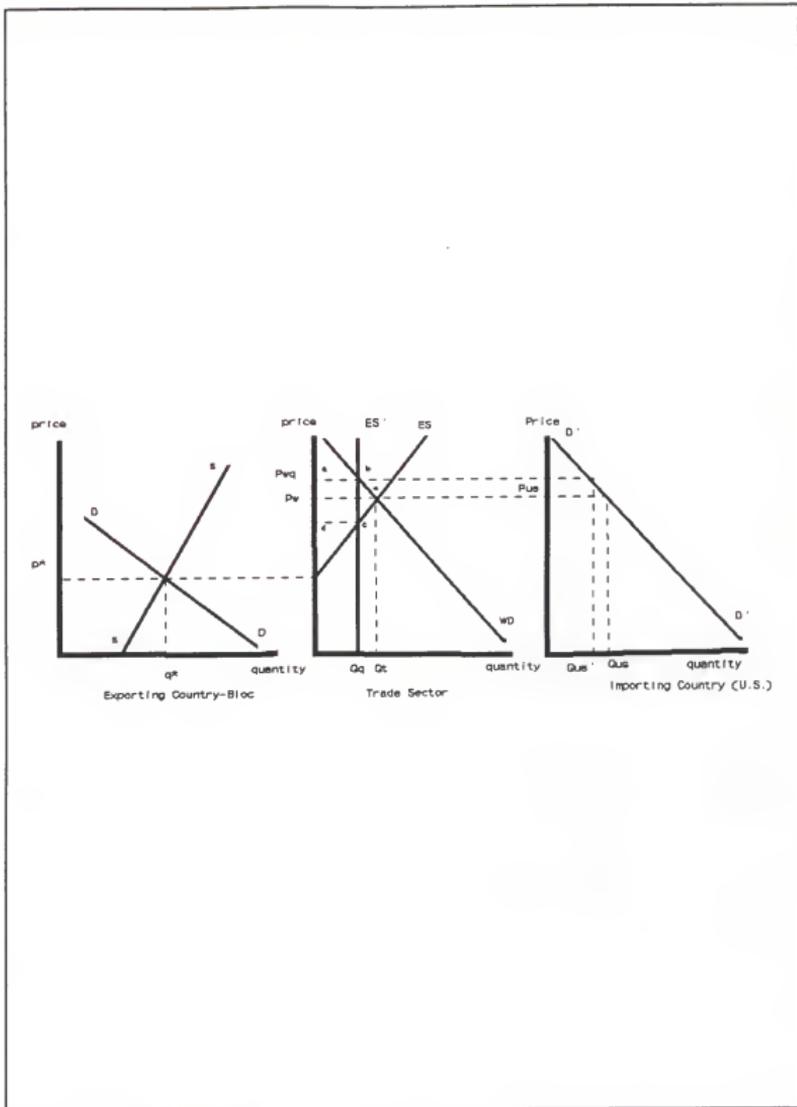


Figure 3. Trade Policy Framework for Coffee

In this case area **abcd** is the quota rent which goes to the exporting country and area **bce** is dead weight social loss resulting from the imposition of the quota. In the case of welfare, there is an expected loss to the consumers in the importing country. The welfare loss can be decomposed into distributional effects, where there is a reduction in the amount of coffee consumed as a result of higher prices and the volume-of-trade effect is lower due to a fall in the volume of coffee traded.

#### Modeling Aggregate Export Supply and Import Demand of Coffee Traded

In the survey of empirical work in international trade, the research can be divided into two broad categories (Kholi, 1991). The first deals with studies related to the verification of different aspects of trade theory, especially related to the Heckscher Ohlin Samuelson (HOS) model.

The second category covers those studies that deal with the estimation of import and export functions. These studies examine the effects of relative prices and volume of trade, based on various specifications, and have been sector specific, global or country-wide. The earlier models were endemic with the following problems. They were based on little or no trade theory, and elasticities that differed significantly from unity were difficult to interpret. In addition, the aggregation of domestic variables appears to be excessive. Also, the use of single equation techniques was inappropriate. The linear and log linear functional forms were said to be inadequate, and too little attention was paid to the definitions of the explanatory variables.<sup>4</sup>

---

<sup>4</sup> Although these problems have been recognized, most of the models estimated are still specified as log linear functional forms. However emphasis has been placed on the definition and inclusion of explanatory variables based on a priori reasoning and theory, and estimation using

As a result, models are now being developed on the foundation of trade theory, however certain assumptions have to be invoked in order to facilitate applied work. For example, in modeling conditional U.S. import demand at the disaggregate level in this study requires the assumption of separability of preferences. This allows commodities to be partitioned into commodity groups, such that preferences within groups (say food as in this case) can be described independently of quantities in other groups (Deaton and Muellbauer, 1980, p 122).<sup>5</sup>

#### General Export Supply and Import Demand Functions

To establish the functional forms of the export supply and import demand, the optimization of industry surplus (consumers and producers surpluses) is examined within the international trade framework as shown in figure 3. The objective function maximizes industry surplus subject to market clearing conditions. Using the Lagrangean (L) to state the problem, assuming no transfer costs, yields the following

$$L = \left[ \int_0^{q_d} d(q_d) dq_d - \int_0^{q_s} S(q_s) dq_s \right] + \mu (Q - q_d) - \lambda (Q - q_s) \quad (4)$$

---

systems of equations. The models are estimated as log linear forms and the definition and inclusion of explanatory variables are based on a priori results and international trade theory. In addition, they are estimated as systems of equations. The aggregate model is nonlinear and a nonlinear estimation technique was used.

<sup>5</sup> This concept will be further elaborated in sections dealing with the development and estimation of the disaggregate U.S. import demand model.

where  $q_d$  is the quantity demanded in the importing country bloc,  $q_s$  is the quantity supplied by the exporting bloc,  $Q$  is the available quantity on the market, and must be equal or greater than the quantity demanded and less than or equal to the quantity supplied,  $d(q_d)$  and  $s(q_s)$  are the inverse or price-dependent demand and supply functions, respectively. The shadow prices for supply and demand are  $\mu$  and  $\lambda$ , respectively.

The Kuhn-Tucker condition, can be used to solve for the export supply and import demand equations, and the international clearing price.

$$\frac{\partial L}{\partial q_d} = d(q_d) - \mu \leq 0 \quad (5)$$

$$\frac{\partial L}{\partial q_d} (q_d) = 0, q_d \geq 0 \quad (6)$$

$$\frac{\partial L}{\partial q_s} = s(q_s) + \lambda \leq 0 \quad (7)$$

$$\frac{\partial L}{\partial q_s} (q_s) = 0, q_s \geq 0 \quad (8)$$

$$\frac{\partial L}{\partial Q} = \mu - \lambda \leq 0 \quad (9)$$

$$\frac{\partial L}{\partial Q} (Q) = 0, \text{ if } Q \geq 0, \text{ then } \lambda = \mu \quad (10)$$

Equations (5) and (7) are the first-order derivatives showing import demand and export supply. In addition to prices, other economic variables also affect export supply and import demand. Given the functional forms with the inclusion of non-price variables and the error term, the unknown parameters can be estimated.

#### Aggregate Supply Equation

The first order conditions of the aggregate model can be used to specify the structural export supply equation,

$$q_{ex} = f (sp_t, INV_{t-1}, TP_t, D, DPRI_t) \quad (11)$$

where  $q_{ex}$  is quantity of all coffee exported worldwide in period  $t$  in pounds,  $sp_t$  is the price (New York spot market price) the group of export firms face in period  $t$  in cents per pound,  $TP_t$  is total production,  $INV_{t-1}$  is the carry over stock or inventory of all coffee at the beginning of period  $t$  in pounds,  $D$  is (the proxy for the export quota) a dummy variable ( $D=1$  when the export quota is binding and  $D=0$  when it is non-binding) and  $DPRI_t$  is an interaction of the policy ( $D$ ) and price variables.

#### Aggregate Import Demand Equations for the U.S. and Rest-of-the-world.

Similarly, the following equation represents the U.S. import demand for all coffee,

$$q_{US} = f (sp_t, USPCDI_t, TEAP_t, COCP_t) \quad (12)$$

where  $q_{US_t}$  is the quantity of all coffee imported into the U.S. in period  $t$  in per capita pounds,  $sp_t$  is the price (New York spot market price) import firms face in period  $t$  in cents per pound,  $USPDI_t$  is the U.S. per capita disposable income in period  $t$  in U.S. dollars,  $TEAP_t$  is the price of tea in period  $t$  in cents per pound and  $COCP_t$  is the price of cocoa in period  $t$  in cents per pound. Income and prices are deflated by the consumer price index (CPI).

The import demand for the rest-of-the-world can be expressed as

$$q_{ROW_t} = f(sp_t, WPCGDP_t, TEAP_t, COCP_t) \quad (13)$$

where  $q_{ROW_t}$  is the quantity of all coffee imported by the rest-of-the-world in period  $t$  in per capita pounds,  $WPCGDP_t$  is the world per capita gross domestic product in time period  $t$  in constant U.S. dollars, and  $sp_t$ ,  $TEAP_t$  and  $COCP_t$  are as defined in equation (12). Additionally, the identity holds where the quantity supplied is equal to the quantity demanded in the U.S. and rest-of-the-world,

$$q_t = q_{US_t} + q_{ROW_t} \quad (14)$$

#### Modeling Conditional U.S. Import Demand for Coffee by Type and Importers' Preferences

Demand for a commodity depends on the price of the commodity in question as well as prices of substitutes and complements, income/expenditure levels, and other significant economic variables, e.g., population. A two-stage budgeting process might

be used to describe this demand structure. For this budgeting process, Consumers first decide on how much to consume of a particular bundle of goods. Then, they decide how much of each product in that bundle to buy. For the present study, once the total consumption level of the bundle (market demand for coffee) has been determined, the allocation among different supplies (product demand) has to be made.

Coffee like many other product categories consists of products that are distinguished by types. The types within this product category are not considered perfect substitutes. U.S. import demand is developed from a strongly separable (additive) utility function which can be written as

$$U = f(v(Q_0) + u(q)) \quad (15)$$

where  $Q_0$  represents the aggregate consumption of a numeraire good,  $q$  is a vector of quantities for different types of coffee, and  $v$  and  $u$  are sub-utility functions.

With the assumption of separability of preferences, coffee can be partitioned as a group of goods so that preferences within that group can be described independently of the quantities in other groups of goods (Deaton and Muellbauer, 1980, p 122-125). The coffee subutility function can be further written as

$$u(q) = u(q_{COL}, q_{DOM}, q_{BRA}, q_{RO}) \quad (16)$$

where  $q$  represents the vector for consumption of the different types of coffee, Colombian Mild ( $q_{COL}$ ), Other Mild ( $q_{OM}$ ), Brazil and Other Arabica ( $q_{BRA}$ ) and Robusta ( $q_{RO}$ ).

Given this assumption, the quantity of different coffee types purchased can be written as a function of the group expenditure and prices within that group. Formally, the U.S. import demand function for a particular coffee type is<sup>6</sup>

$$q_{USi} = f(p_i, E_i) \quad (17)$$

where  $q_{USi}$  is the per capita quantity of coffee type  $i$  (Colombian Mild, Other Mild, Brazil and Other Arabica, and Robusta) imported into the U.S. in time period  $t$  in per capita pounds,  $p_i$  is the vector of prices for types ( $p_1, \dots, p_4$ ) of coffee in time period  $t$  in cents per pound, and  $E_i$  is the expenditure on all coffee imported into the U.S. in time period  $t$  in per capita U.S. dollars.<sup>7</sup>

---

<sup>6</sup> These demand functions are derived as Marshallian Demand curves using the Lagrangean technique to impose the budget constraint. Additionally, this research is conducted at the import level, using shipping point data instead of consumer level data. Hence, the results obtained are applicable to shipping point or wholesale level.

<sup>7</sup> When separability is assumed, the expenditure variable could be endogenous (LaFrance, 1991). This possibility of simultaneous equation bias can be tested. In the present research the Hausman specification test (Hausman, 1978) was used to test for possible endogenous expenditure. The chi-square statistics with seven degree of freedom were 3.80, 3.25, 0.027 and 0.022 for the different types. The tests indicated a failure to reject the null hypotheses at the 10% level of statistical significance, reinforcing the assumption that there is no expenditure endogeneity. Several works on import demand have justified the incorporation of expenditure instead of income in the demand function (M. Goldstein and M.S. Khan, 1985; and A. Brillembourg, 1975).

The consumption of coffee is driven partially by the importers behavioral patterns and market demand. Both economic and non-economic factors stimulate any deviation from these consumption patterns. Behavioral patterns toward routine purchases of a product are frequently referred to as habit persistence. While coffee purchases do not show complete habit persistence, some element of it exists and must be considered when determining strategies to influence demand and/or project expected demand for future periods.

Let  $q_{it}$  be (actual) per capita consumption of coffee type  $i$  in time period  $t$ , with  $p_i$  and  $E_t$  being factors influencing demand. To incorporate habit persistence, we assume that the relative change in actual consumption is dependent on the desired level of consumption relative to the actual consumption in the previous period. This is represented as,

$$\frac{q_{it}}{q_{it-1}} = \left( \frac{q_{it}^*}{q_{it-1}} \right)^\gamma \quad (18)$$

where  $q_{it}^*$  is the desired level.

Incorporating the independent variables, the desired quantity ( $q_{it}^*$ ) can be expressed as

$$q_{it}^* = f(p_i, E_t) \quad (19)$$

Substituting (19) into (18) for  $q_{it}^*$  and applying logarithmic transformation, the conditional import demand for coffee can be expressed as

$$\ln q_{it} = \gamma \ln (f(p_t, E_t)) + (1-\gamma) \ln q_{it-1} \quad (20)$$

where  $\ln q_{it-1}$  is a one period lag of the dependent variable.

Using the boundaries  $0 \leq \gamma \leq 1$ , if  $\gamma = 1$ , then in equation (20) there is no habit persistence and the importation of coffee is dependent only on  $p_t$  and  $E_t$ . If  $\gamma = 0$ , habit persistence is perfect and importation in this period is equal to importation in the previous period; here  $p_t$  and  $E_t$  have no impact on the import demand.

#### Estimated Equations and Proposed Models

The following structural equations for aggregate supply, inventory and demand for coffee were estimated as double logs with the identity holding.

$$\ln q_{it} = \alpha_0 + \alpha_1 \ln sp_t + \alpha_2 \ln INV_{t-1} + \alpha_3 \ln TP_t + \alpha_4 D + \alpha_5 (D * \ln sp_t) + e_{1t} \quad (21)$$

$$\ln q_{US_t} = \beta_0 + \beta_1 \ln sp_t + \beta_2 \ln USPCDI_t + \beta_3 \ln TEAP_t + \beta_4 \ln COCP_t + e_{2t} \quad (22)$$

$$\ln q_{ROW_t} = \gamma_0 + \gamma_1 \ln sp_t + \gamma_2 \ln WPCGDP_t + \gamma_3 \ln TEAP_t + \gamma_4 \ln COCP_t + e_{3t} \quad (23)$$

$$q_{it} = q_{US_t} + q_{ROW_t} \quad (24)$$

The  $\alpha$ 's and  $\beta$ 's and  $\gamma$ 's are coefficients to be estimated. Based on equation (20) the following equation for conditional U.S. import coffee demand by type was estimated

$$\ln q_{USit} = \delta_{10} + \delta_{11} \ln E_t + \delta_{12} \ln p_t + \delta_{13} \ln q_{it-1} + v_{it} \quad (25)$$

The  $\delta$ 's are coefficients to be estimated with  $\delta_{12}$  being a vector of coefficients and  $\delta_{13}$  equal to  $1 - \gamma$ .

#### Estimation Methods

The structural equations for the aggregate export supply (equation 21), and import demands (equations 22 and 23) were estimated as a system. The total quantity exported is expressed as a function of the New York spot market price, the annual beginning inventory level, total production, a dummy variable as a proxy for trade policy and an interaction variable consisting of the dummy and the price. The New York spot market price was included based on evidence from previous research showing its significance in influencing the market and its use in guiding the ICO price indicator (Ford, 1977; Vogelvang, 1992). It is quoted on the basis of Unwashed Arabica which is produced by Brazil, the dominant producer and trader. Akiyama and Varangis (1989) suggested the inclusion of carry over stocks (inventory) and total production as explanatory variables in the supply model. Inventory levels are expected to affect release quantities or supplies. Increases in inventory levels are expected to result in increased release quantities and result in a decline in prices and *vice versa*. Similarly, total production will also influence release quantities or supply. The dummy variable was used as a proxy for the export quota policy to examine shifts in the intercept and price

slope. The dummy variable was interacted with the price variable to examine any policy-induced change in the price slope of the regression. A binding export quota will reduce supplies in the market.

Aggregate U.S. import demand was specified with per capita quantity of all coffee imported as a function of the New York spot market price, U.S. per capita disposal income (constant U.S. dollars), and prices of tea and cocoa to capture expected substitution relationships. The spot market price was included because import demand is estimated at the wholesale level.

The rest-of-the-world demand equation was specified as a function of the New York spot market price, world per capita gross domestic product and the prices of tea and cocoa. The spot market price was included because it represents the international price (single price) for coffee. World per capita gross domestic product (constant U.S. dollars) was used as a proxy for income to examine the causal effect it is likely to have on demand.

Quantities were expressed on a per capita basis.<sup>8</sup> The spot market price, tea and cocoa prices were deflated by the consumer price index. The system was estimated as double log model system of equations. Based on the conceptual framework and economic theory, a simultaneous equation estimator was deemed as the most appropriate approach to be used to estimate the aggregate export supply and demand equations. The identification process for a nonlinear simultaneous system is quite different from that of

---

<sup>8</sup> U.S. population figures were used for U.S. import demand. Population figures based on region were used for the Rest-of-the World import demand (Urban and Nightingale, 1993).

a linear system (Fisher, 1976). In order to satisfy the identification process, the nonlinearity of the variables must be considered. In this study the nonlinearity of the variables is the result of the export supply and import demands connected by a nonlinear identity. This allows for additional variables from the nonlinear condition to be used to identify the equations. In addition, because of the nonlinearity, the closed form analytical solutions for the reduced form equations do not exist, but can be solved numerically (Greene, 1990). Order (necessary) and rank (sufficient) conditions were satisfied in the identification of the above equations. Each equation is over identified. In a system with over identified equations there is more information than is required for the estimation of the parameters. An appropriate estimator must be employed to take into account this situation and to yield estimates that are asymptotically efficient and consistent. The appropriate system estimator used for this model is nonlinear three stage least squares (NL3SLS). The TSP econometric package (Hall et al., 1995) was used to generate 3SLS estimates. The instrumental variables consisted of all the predetermined variables, their squares and cross products, and the constant term (A. Gallant, 1987). Evidence for structural changes based on different trade policy regimes were evaluated in the aggregate model.

The equations for conditional U.S. import demands for coffee by type (equation 25) were estimated as a second system under the assumption of cross equation correlation of the disturbances. Each equation in the model was specified as a function of the overall expenditure on coffee, prices for all types and a one period lag on the dependent variable (used to incorporate the importers' preferences by type). The four demand

equations for the different coffee types were estimated in double logs. Quantities were converted to a per capita basis. To impose homogeneity, prices were normalized by one of the coffee prices ( i.e., Robusta price), with expenditure also normalized by the robusta price and expressed on a per capita basis. The equations were operationalized by adding the respective error terms. Parameter estimates are expected to be consistent and asymptotically efficient for the model. Given the assumption of cross-equation correlation of the error terms, the system of equations was estimated using Seemingly Unrelated Regression Techniques (SUR) (Greene, 1990). TSP econometric package was used in estimating the models. Structural change was also evaluated using dummy variables for different policy regimes. The Wald statistical test was used to evaluate structural changes based on different policy regimes. The restrictions of adding up and symmetry were not imposed due to the double log specification of the model (Deaton and Muellbauer, 1980, pp 17 and 45).<sup>9</sup>

---

<sup>9</sup> In demand analysis certain restrictions are imposed on the derivatives of the demand function rather than the function themselves (Deaton and Muellbauer, 1980). These are used to restrict the parameter space and to allow the function specifications to conform to the properties of the demand function. In general, the restrictions of adding-up and homogeneity are imposed as a consequence of the assumption of a linear budget constraint and, symmetry and negativity are derived from the second order condition. However, models can be specified without the imposition of one or more restrictions. For instance, in the specification of double log demand models adding-up and symmetry cannot be imposed. In the international trade literature, double log models are used to estimate import demand without the imposition of restrictions (A.Intalianer and G. d'Alacantara, 1986). The current research evaluated several specifications for the disaggregated import demand model. This was because the data on prices were suspected to show moderate to severe multicollinearity as checked by the examination of the condition number (701) and condition index (26) (see Greene 1990 p 35, 280-281). In addition, Dickey-Fuller tests (degrees of freedom 30,1) were done on all the endogenous and exogenous variables. The tests revealed that the endogenous variables (quantity values of 4.85 to 6.56) were stationary and exogenous variables (price values of 1.6 to 1.48 and expenditure value of 2.61) were non-stationary. The double log model with homogeneity imposed, yielded

Data

Annual data for the period 1964-94 were obtained for use in the analysis. The primary data sources were the International Coffee Organization, USDA Foreign Agricultural Service, the U.S. Bureau of Labor Statistics, U.S. Department of Labor and Bureau of Census, Economic Report of the President, and the World Bank.

Time series data for imported quantities, prices, annual total production and inventory were obtained from the International Coffee Organization (unpublished data) and the USDA Foreign Agricultural Service (United States Department of Agriculture, 1994).

World per capita gross domestic product was taken from World Bank Data Tables (World Bank, 1995). U.S. per capita disposable income, the consumer price index (CPI) and the U.S. population were taken from the U.S. Bureau of Labor Statistics, U.S. Department of Labor and Bureau of Census, and the Economic Report of the President (1986). Data on world population by country and region were obtained from Urban and Nightingale (1993).

---

the reported estimates. However, caution must be exercised in the interpretation of those estimates, and especially inferences with policy implications, given data problems discussed.

CHAPTER 5  
EMPIRICAL RESULTS AND DISCUSSION

Empirical Results

The results are presented in this chapter for the aggregate world trade model and the disaggregate model for U.S. import demand by coffee type. Based on statistical tests, structural changes both in the aggregate and disaggregate models were suggested. Results are presented based on these tests and from the pooled sample. A summary of the results is presented with a discussion about the implications for the industry.

Aggregate Export Supply and Import Demand For Coffee

Table 8 presents the estimated coefficients of the aggregate structural model and their significance for the pooled sample. The estimates of the explanatory variables are reported, and are evaluated at statistical significance levels of 5% and 10% (i.e.,  $\alpha = 0.05$  and  $0.10$ ). The export supply curve was upward sloping, i.e., the sign on the estimated parameter for the spot market price was positive, indicating that as price increases the quantity supplied also increases. Similarly, coefficients were positive for inventory and total production.

All explanatory variables in the export supply equation were statistically significant at the 5% level, except for the policy and the interaction variables. The results suggest that supply is price inelastic with a 1% increase in the price of coffee causing an increase in the quantity of coffee supplied by 0.13%.

Table 8. Parameter Estimates for the Aggregate Structural Model for Export Supply, Aggregate Demand for Coffee in the U.S. and Rest-of-the-world Over the Pooled Sample (1964 -1994).

Variables <sup>1</sup>	Aggregate Export Supply	Aggregate U.S. Coffee Demand	Aggregate Rest-of-the-world Demand
Intercept	14.21 (2.25) <sup>a</sup>	20.04 (2.42) <sup>*</sup>	21.11 (1.03) <sup>*</sup>
Spot market Price (SP)	0.13 (0.02) <sup>*</sup>	-0.17 (0.06) <sup>*</sup>	-0.13 (0.05) <sup>*</sup>
Inventory (INV <sub>t-1</sub> )	0.11 (0.05) <sup>*</sup>	N.I. <sup>b</sup>	N.I.
Total Production (TP)	0.13 (0.07) <sup>*</sup>	N.I.	N.I.
World Per Capita GDP (WPCGDP)	N.I.	N.I.	0.19 (0.10) <sup>**</sup>
U.S. Per Capita Disposable Income (UPCDI)	N.I.	0.32 (0.12) <sup>*</sup>	N.I.
Policy (D)	-0.05 (0.36)	N.I.	N.I.
Policy*Price (DPRI)	0.02 (0.07)	N.I.	N.I.
Tea Price (TEAP)	N.I.	0.06 (0.10)	-0.03 (0.07)
Cocoa Price (COCP)	N.I.	0.08 (0.06)	-0.08 (0.05)

<sup>1</sup> Variables were estimated as logs except the dummy(D). The variable DPRI is the dummy times log of price.

<sup>a</sup> Standard errors are presented in parentheses below the parameter estimates.

<sup>\*</sup> Estimate is statistically significant at 5% level of significance.

<sup>\*\*</sup> Estimate is statistically significant at 10% level of significance.

<sup>b</sup> N.I. indicates this variable was not included in the corresponding equation for estimation.

Inventory or carry over stock was statistically significant at the 5% level. The estimated coefficient for this variable shows that a 1% increase in inventory will result in a 0.11% increase in quantity supplied. Similarly, total production was statistically significant at the 5% level with its estimated coefficient value at 0.13. This result indicates that a 1% increase in total production of coffee results in a 0.13% increase in quantity supplied.

The estimated aggregate demand curves were downward sloping with negative coefficients on the spot market price variable, i.e., the quantity of coffee demanded declines as price increases as suggested by theory. The signs of the coefficients on world per capita gross domestic product (world income) and U.S. per capita disposable income (U.S. income) were positive, indicating that quantity demanded increases as income increases. The increase in income denotes an outward shift in demand at given prices.

All parameter estimates in the aggregate U.S. coffee demand equation were statistically significant at the 5% level, except for those on the prices of tea and cocoa. The own-price elasticity was -0.17 for coffee in the U.S. This indicates that a 1% increase in the price of all coffee results in a decline in the quantity demanded in the U.S. by 0.17%. If we assume equi-proportional effects between the wholesale and retail prices, symmetric price transmission, then a 1% increase in price at those levels will affect the quantity demanded in the same proportion (0.17%). These results suggest U.S. aggregate coffee demand is price inelastic, implying that while there may be close substitutes across coffee types, coffee in general has no major substitutes.

In terms of U.S. per capita disposable income, the sign indicates that as income rises the quantity of coffee demanded increases. The coefficient was statistically significant at the 5% level. The results showed that a 1% increase in U.S. income increases demand in the U.S. for all coffee by 0.32%, indicating that coffee demand has grown at a slower pace than changes in income.

All explanatory variables for the rest-of-the-world (ROW) demand equation were statistically significant, except for the tea and cocoa price variables. The demand curve was shown to be downward sloping. The results indicate that a 1% increase in price causes ROW demand for all coffee to decline by 0.13%. Again coffee is price inelastic.

The parameter estimate for world per capita gross domestic product (world income) showed that as world income rises, the quantity of coffee demanded increased. The coefficient was statistically significant at the 10% level. However, coffee is income inelastic, indicating that ROW coffee demand has grown at a slower pace than changes in income. The estimate showed that ROW coffee demand increased by 0.19% with a 1% increase in income.

Table 9 presents the aggregate supply and demand parameter estimates by trade policy regimes (export quota binding vs quota non-binding periods). The data were partitioned by the trade policy variable D, into quota binding versus quota non-binding periods and partition-specific aggregate supply and demand estimates were obtained. The export supply was upward sloping in both periods, i.e., the sign on the two parameter estimates for the spot market price were positive. However, the coefficient on the spot

Table 9. Parameter Estimates for the Aggregate Structural Model for Export Supply, Aggregate Demand for Coffee in the U.S. and Rest-of-the-world with the Export Quota Policy Binding (D=1) and Non- Binding(D=0),(1964 -1994).

Variables <sup>1</sup>	Aggregate Export Supply		Aggregate U.S. Coffee Demand		Aggregate Rest-of-the-world Demand	
	(D=1)	(D=0)	(D=1)	(D=0)	(D=1)	(D=0)
Intercept	-2.97 (4.33)	15.38 (3.27) <sup>**</sup>	-7.47 (5.22)	25.06 (4.39) <sup>*</sup>	3.74 (2.48)	17.93 (1.09) <sup>*</sup>
Spot market Price (SP)	0.08 (0.09)	0.14 (0.03) <sup>*</sup>	-0.27 (0.13) <sup>**</sup>	-0.36 (0.09) <sup>*</sup>	-0.05 (0.13)	-0.14 (0.08) <sup>*</sup>
Inventory (INV <sub>t-1</sub> )	0.15 (0.08) <sup>***</sup>	0.01 (0.07)	N.I. <sup>b</sup>	N.I.	N.I.	N.I.
Total Production (TP)	0.04 (0.15)	0.20 (0.11) <sup>***</sup>	N.I.	N.I.	N.I.	N.I.
World Per Capita GDP (WPCGDP)	N.I.	N.I.	N.I.	N.I.	0.43 (0.28)	0.21 (0.23)
U.S. Per Capita Disposable Income (UPCDI)	N.I.	N.I.	0.72 (0.50)	0.82 (0.43) <sup>***</sup>	N.I.	N.I.
Tea Price (TEAP)	N.I.	N.I.	0.09 (0.21)	0.04 (0.17)	0.04 (0.16)	-0.13 (0.14)
Cocoa Price (COCP)	N.I.	N.I.	0.23 (0.14)	0.22 (0.18)	-0.05 (0.13)	0.02 (0.12)

<sup>1</sup> Variables were specified as logs expect the dummy (D) and DPRI is the dummy times log of prices.

<sup>\*</sup> Standard errors are presented in parentheses below the parameter estimates.

<sup>\*\*</sup> Estimate is statistically significant at 5% level of significance.

<sup>\*\*\*</sup> Estimate is statistically significant at 10% level of significance.

<sup>b</sup> N.I. indicates this variable was not included in the corresponding equation for estimation.

market price was not statistically significant ( $\alpha = 0.05$ ) during the export quota binding period. Similarly, the sign on the coefficients for inventory and total production were positive, but the inventory coefficient was statistically significant ( $\alpha=0.10$ ) only when the export quota was binding, and the total production coefficient estimate being significant ( $\alpha = 0.10$ ) only when the quota was non-binding. This indicates that during the binding quota period an increase in carry over stocks will stimulate an increase in supply, while when the quota is non-binding an increase in total production (i.e., fresh out from the field) will cause an increase in the quantity supplied. It can be deduced that during the binding quota period inventory levels influenced supply decisions, while during non-binding quota period total production influenced supply decisions.

The results showed that supply during the non-binding quota period was price inelastic at 0.14, with a 1% increase in the spot market price resulting in a 0.14% increase in shipments of coffee. Also, a 1% increase in total production increases exported quantities 0.20% during the non-quota binding period. During binding quota periods, a 1% increase in carry over stocks or inventory level causes a 0.15% increase in export quantities supplied.

The demand curves were downward sloping with negative coefficients on the price variables for U.S import and rest-of-the-world demands in both trade policy regimes. These indicate that the quantity of coffee demanded declined as price increased given the trade policy regimes. The signs of the coefficients on the variables used as proxies for world and U.S. incomes were positive for both the non-binding and binding quota periods. These indicate that quantity demanded increased as income increased.

Parameter estimates in the aggregate U.S. coffee import demand were statistically significant ( $\alpha = 0.05$ ) for prices in both trade policy regimes, and for income ( $\alpha = 0.10$ ) during non-binding quota periods. An inverse relationship was seen with respect to the quantity demanded and the spot market prices in both quota binding and non-binding periods. Aggregate U.S. coffee import demand was price inelastic in both trade policy regimes. The price elasticities were -0.27 and -0.36 in quota binding and non-binding periods respectively. That is, a 1% increase in the price of coffee results in a decline in total quantity demanded by 0.27% and 0.36% in quota and non-binding periods respectively.

Aggregate U.S. coffee import demand was income inelastic in the non-binding period. The results show that with 1% rise in U.S. per capita income, coffee demand increases by 0.83%. It can be deduced that coffee demand will grow at a slower pace than changes in U.S. income.

Rest-of-the-world demand was price inelastic. The parameter estimate was -0.14, indicating that a 1% increase in the price of coffee will decrease the demand for coffee in the rest-of-the-world by 0.14%. The parameter for world income (world per capita gross domestic) was not statistically significant during either trade policy regime. Likewise, for the rest-of-the-world demand, as well as U.S. demand, the coefficients on tea and coffee prices were not statistically significant during either trade policy regime.

#### Test for Evidence of Structural Changes in Aggregate Model

Tests for equality of parameters in the binding and non-binding export quota periods were done for the aggregate export supply equation, and U.S and rest-of-the-

world import demand equations. The Wald statistical test for the export supply equation yielded a chi-square value of 13.02 with four degrees of freedom, greater than the table value (9.49) at the 5% level. Hence, the null hypothesis was rejected, indicating that there is structural change in export supply given the ICA agreement.

The Wald statistical tests results for the U.S. and rest-of-the-world import demand equations gave a chi-square value of 24.10 with ten degrees of freedom, which was greater than the table value (18.31) at the 5% level. The null hypothesis was rejected, indicating that there is structural change in U.S and rest-of-the-world import demands given the ICA agreement.

#### Conditional U.S Import Demand by Coffee Types

The parameter estimates and standard errors of the structural model for U.S import demand by coffee types are presented in table 10 and represent short-run estimates of elasticities. Estimates of "long-run" import demand elasticities may be obtained by dividing the short-run import demand estimates by one minus the coefficient value on the lagged dependent variable, after dropping that variable. All of the estimated demand curves were downward sloping with respect to the own price variable. The coefficients on the coffee expenditures were positive, indicating that the amount of consumed coffee increased for each coffee type as expenditure increased or demand shifts outward as expenditure rises.

Table 10. Parameter Estimates for the Structural Model for Conditional U.S. Import Demand of Coffee by Type (1964 - 1994)

Variables <sup>1</sup>	Colombian Mild	Other Mild	Brazil and Other Arabicas	Robusta
Intercept	8.41* (0.54)*	9.13* (0.65)	10.72* (0.68)	9.10* (0.72)
Expenditures (E)	1.03* (0.09)	0.91* (0.10)	1.03* (0.09)	1.15* (0.12)
Price Colombian (PCOL)	-0.01 (0.28)	1.22* (0.34)	-1.11* (0.39)	-1.65* (0.42)
Price Other Mild (POM)	-0.28 (0.37)	-1.33* (0.44)	-0.46 (0.50)	-0.82** (0.51)
Price Brazil and other Arabicas (BRA)	-0.74* (0.30)	-0.80* (0.34)	-0.26 (0.39)	1.40* (0.43)
Price Robusta (PRO)	-0.91* (0.28)	-0.88* (0.32)	0.88* (0.37)	-1.12* (0.38)
Importers Preferences ( $Q_{it-1}$ )	0.17* (0.07)	0.13 (0.08)	-0.04 (0.08)	0.15** (0.08)

<sup>1</sup>Variables were estimated in logs.

\*standard errors are in parenthesis.

\*Estimate is statistically significant at 5% level of significance.

\*\*Estimate is statistically significant at 10% level of significance.

Colombian Mild. Coffee classified within this group is produced mainly in Colombia, Tanzania and Kenya. These countries are the main suppliers of coffee to the U.S. market. The expenditure elasticity was significantly different from zero ( $\alpha = 0.05$ ); the sign was consistent with expectation. The expenditure elasticity estimate was

slightly greater than unity (1.03) indicating that a 1% increase in expenditures will stimulate a 1.03% increase in the total quantity of Colombian Mild consumed. Own price elasticity was not statistically significant ( $\alpha = 0.05$ ). This suggests a weak relationship between own price and the quantity of this type of coffee consumed. All the cross price elasticities had negative signs indicating that Colombian Mild has a complementary relationship with other coffee types. The price variables for Brazil and Other Arabicas (-0.74) and Robusta (-0.91) were statistically significant ( $\alpha = 0.05$ ). This result is consistent with trading activities in the market where Brazil and Other Arabica, and Robusta are used as blending coffees with Columbian Mild. The results suggest persistence in the import demand for Colombian Mild.<sup>10</sup> The lagged-quantity coefficient (0.17) was statistically significant at the 5% level. Current consumption is influenced significantly by previous consumption, as reflected by this variable.

Other Milds. The main producers and sources of other mild imports into the U.S. are Central and Latin American Countries, India, Dominican Republic, Haiti, Jamaica, Burundi and Malawi. However, most of the ICO members growing this type of coffee are exempt from the basic export quota (Table 5). The expenditure elasticity estimate was statistically significant ( $\alpha = 0.05$ ) at 0.91, indicating that a 1% increase in expenditure results in an increase in total demand for Other Milds by 0.91%. This coffee type also dominates the high end of the market, especially with the rapid proliferation of specialty coffee stores in upscale metropolitan areas. The own price

---

<sup>10</sup> This result was supported through the evaluation of the importers preference variable in the model using the Durbin-H statistic. The calculated Durbin-H statistic was 0.65 for Colombian Mild, 0.71 for Robusta indicating no evidence of serial correlation.

elasticity was statistically significant ( $\alpha = 0.05$ ). The estimate indicates that quantity demanded declines by 1.33% with a 1% increase in the price for Other Mild coffee. Cross price elasticities were statistically significant at the 5% level for all coffee types. A substitution relationship was seen between Other Milds and Colombian Mild (1.22). Complementary relationships were seen between Other Milds and Brazil and Other Arabicas (- 0.80), and Robusta (-0.88). The coefficient estimate for importers' preferences was not statistically significant. This implies that there was no strong or conclusive consumption pattern between previous shipments and current consumption.

Brazil and Other Arabicas. The major producers that are sources of imports into the U.S. for Brazil and Other Arabica coffees are Brazil, Bolivia, Ethiopia and Paraguay. The expenditure elasticity was statistically significant at 1.03; the sign was consistent with expectation. This indicates that a 1% increase in expenditures will result in 1.03% increase in the quantity of Brazil and Other Arabica demanded. The Own price elasticity was not statistically significant ( $\alpha = 0.05$ ). This result suggests a weak relationship between own price and the quantity of this type of coffee consumed. All cross price elasticities were statistically significant at the 5% level, except for Other Milds. Brazil and Other Arabica has a complementary relationship with Colombian Mild (-1.11). A substitution relationship was found between Brazil and Other Arabica and Robusta (0.88). Evidence of importers' preferences for Brazil and Other Arabica could not be established.

Robusta. The major producers that are sources of imports into the U.S. for Robusta coffee include Indonesia, most of the African countries, East Asia, Trinidad and Tobago. The expenditure elasticity was statistically significant ( $\alpha = 0.05$ ) at 1.15. The

result indicates that a 1% increase in expenditure increases the total quantity of Robusta consumed by 1.15%. Comparing this result with the results for the other types of coffee, one can see that Robusta is more responsive to changes in expenditures than the other coffee types. Robusta dominates the low end of the coffee market and is used for blending. The own price elasticity was statistically significant ( $\alpha = 0.05$ ) at 1.12. All Cross price elasticities were statistically significant, indicating strong complementary and substitution effects. Complementary relationships were seen with respect to Colombian Mild (-1.65) and Other Milds (-0.82) and a substitution relationship with Brazil and Other Arabica (1.40). The coefficient estimate for importers preference (0.15) was statistically significant at the 10% level. This implied that previous consumption positively impacts current consumption. This can be attributed to the use of this type of coffee in blending and its increased use in the preparation of instant coffee in the U.S.

#### Test For Structural Changes in the Disaggregate Model

While the policy variable (Dummy) was not explicitly included in the disaggregate conditional U.S. import demand equations, dummy variables were used to test for structural changes in the intercept and slope coefficients in the disaggregate model.

Conditional U.S. import demand under binding and non-binding export quota regimes can be compared by using dummy variables (Greene, 1990). Formally, the dummy-variable of import demand model (25) is

$$\ln q_{USH} = (\delta_0^0 + \delta_0^1 D) + (\delta_{11}^0 + \delta_{11}^1 D) \ln E_i + (\delta_{12}^0 + \delta_{12}^1 D) \ln P_i + (\delta_{13}^0 + \delta_{13}^1 D) \ln q_{it-1} + \mu_{it} \quad (26)$$

From equation (26), demand responses for each policy regime can be obtained. When D is equal to zero, i.e., the export quota is non-binding, we have

$$\ln q_{USit} = \delta_{i0}^0 + \delta_{i1}^0 \ln E_t + \delta_{i2}^0 \ln p_t + \delta_{i3}^0 \ln q_{it-1} + \mu_{it} \quad (27)$$

Alternatively, when D is equal to one, i.e., the export quota is binding, we have

$$\ln q_{USit} = (\delta_{i0}^0 + \delta_{i0}^1) + (\delta_{i1}^0 + \delta_{i1}^1) \ln E_t + (\delta_{i2}^0 + \delta_{i2}^1) \ln p_t + (\delta_{i3}^0 + \delta_{i3}^1) \ln q_{it-1} + \mu_{it} \quad (28)$$

Based on the estimates of equation (26) the Wald test was used to test the null hypothesis for structural changes. Table 10 shows the parameter estimates of both models. In testing for intercepts, the computed Wald statistic of 10.28 ( $\alpha = 0.05$ ) at 4 degrees of freedom was greater than table Chi-square value of 9.48; therefore, the null hypothesis of no structural change is rejected. This suggests structural changes have occurred when one trade policy regime was evaluated against the other.

For the slopes, the computed Wald statistic of 78.38 ( $\alpha = 0.05$ ) at 24 degrees of freedom was greater than table Chi-square value of 36.42 therefore the null hypothesis of no structural change is rejected. This again suggests structural change when one trade policy regime was evaluated against the other.

As shown in the table, the differential intercept coefficients by coffee type were statistically significant ( $\alpha = 0.05$ ) in the non-binding quota periods. Lower coefficient estimates were seen for all coffee types in binding quota period.

Table 11. Parameter Estimates for Conditional U.S. Import Demand by Coffee Types Under Binding ( $D = 1$ ), and Non-Binding ( $D = 0$ ) Export Quota Regimes

Variables <sup>1</sup>	Colombian Mild		Other Mild		Brazil and Other Arabica		Robusta	
	D=0	D=1	D=0	D=1	D=0	D=1	D=0	D=1
Intercept	9.56* (1.49) <sup>a</sup>	-1.21* (1.59)	11.36* (2.26)	-1.73 (2.35)	10.74* (2.11)	-0.01 (2.21)	9.51* (1.50)	0.63 (1.60)
Exp (E)	1.16* (0.26)	0.14 (0.30)	0.99* (0.33)	0.09 (0.35)	0.88* (0.34)	0.19 (0.35)	0.75* (0.29)	0.30 (0.31)
PCOL	-0.40 (0.49)	-0.04 (0.67)	0.11 (0.63)	-1.07 (0.85)	0.5E <sup>02</sup> (0.64)	-1.55 <sup>***</sup> (0.88)	-1.57* (0.59)	-1.66* (0.79)
POM	-0.29 (0.58)	0.25 (0.71)	-0.20 (0.82)	-1.55 <sup>***</sup> (0.91)	-0.29 (0.79)	-0.59 (0.97)	-1.44* (0.65)	-1.59 <sup>***</sup> (0.81)
PBA	-0.12 (0.47)	-0.66 (0.66)	-0.94 <sup>**</sup> (0.56)	-1.00 (0.78)	-0.49 (0.59)	-0.17 (0.83)	2.44* (0.47)	-3.15* (0.75)
PRO	-0.82 <sup>***</sup> (0.44)	-0.16 (0.60)	-1.15* (0.20)	-0.48 (0.68)	0.88 (0.60)	0.51 (0.81)	-0.65 (0.51)	-0.38 (0.74)
Q <sub>it-1</sub>	-0.07 (0.18)	-0.11 (0.19)	-0.09 (0.28)	0.14 (0.11)	0.12 (0.23)	0.11 (0.25)	-0.02 (0.14)	0.01 (0.16)

<sup>1</sup>Variables were specified in logs.

<sup>a</sup>standard errors are in parenthesis.

\*Estimate is statistically significant at 5% level of significance.

\*\*Estimate is statistically significant at 10% level of significance.

The results suggest that expenditure elasticities for coffee types are the same in both regimes. The coefficients for own price were not statistically significant, except for Other Milds in the binding quota period. However, slope coefficient estimates for cross prices were statistically significant for Colombian Mild and Robusta in non-binding quota periods; Other Milds and Brazil and Other Arabica; and Other Milds and Robusta in the non-binding quota period. The cross-price coefficient estimate for Brazil and Other

Arabica demand with respect to the Colombian Mild price was significant in binding quota periods; while the Robusta demand relationship with respect to prices for Colombian Mild, Other Milds and Brazil and Other Arabica were significant in both periods.

#### Discussion and Implications

The research provides evidence for the following results. The results of aggregate export supply, U.S. and rest-of the world demand models indicate:

- (i) export supply is influenced by the New York Spot market price, but is price inelastic;
- (ii) export supply is affected by inventory and total production;
- (iii) both aggregate demand models are influenced by the New York spot market price, however the price elasticities of demand were inelastic;
- (iv) world income influences rest-of-the-world demand, however rest-of-the-world demand is income inelastic;
- (v) U.S. disposable income influences U.S. import demand and is income inelastic;
- (vi) inventory is more likely to influence export supply decisions when the export quota is binding;
- (vii) total production is more likely to impact export supply decisions when the export quota is non-binding; and
- (viii) New York spot market prices influence U.S. demand in both trade policy regimes, but has its most influence in non-binding quota periods for the rest-of-the-world.

The results of the disaggregate conditional U.S. import demand and the allocation of expenditures on coffee by type indicate:

- (i) expenditures elasticities were significant for all types of coffee, however they were elastic for Colombian Mild, Brazil and Other Arabica and Robusta, but inelastic for Other Milds, so a general increase in expenditures on all coffee will increase quantity demanded for Colombian Mild, Brazil and Other Arabicas, and Robusta more so than Other Milds;
- (ii) own price elasticities were statistically significant only for Other Mild and Robusta;
- (iii) the cross price elasticities were significant for the following combinations: Colombian Mild and Brazil and Other Arabicas (complements), Colombian Mild and Robusta (complements), Other Milds and Colombian Mild (substitutes), Other Mild and Brazil and Other Arabica (complements), Robusta and Other Milds (complements), and Robusta and Brazil and Other Arabica (substitutes);
- (iv) importers' preferences were significant for Colombian Mild and Robusta;
- (v) under the binding and non-binding export quota regimes, intercepts were significantly different for all types of coffee, and the own price coefficient was significantly different for Other Milds;
- (vi) different cross price relationships were estimated in the two policy periods for Colombian Mild with Brazil and Other Arabica (complements in binding quota periods), for Robusta with Colombian Mild; and Robusta with Other Milds (complements in both quota periods), and for Brazil and Other Arabica, with

Robusta (substitutes in non-binding quota periods and as complements in binding quota periods); and

- (vii) in general, evidence of structural change was observed under the different trade policy regimes.

The level of carry over stocks or beginning annual inventory and total production both influence export supply, even in the presence of price inelasticity for exported coffee. The results of the aggregate model would imply that high inventory levels (carry over stocks) or production of fresh coffee will depress prices. As a result, export revenues continue to be low in periods of excess inventories and high production. Even with the recently proposed export retention scheme, prices and revenues are not likely to improve given the current large inventories and increasing production.

One possible action the newly formed Association of Coffee Producing Countries could take to stimulate demand would be through brand marketing based on types and or an increase value-added activities (in the producing countries). This would be a move toward producing diversified end products for coffee exports. Coffee traded as a primary commodity seems to satisfy the conditions of inelastic supply and demand for primary agricultural goods. Therefore, producing countries, especially Brazil and Colombia, may be advised to embark upon value-added activities (i.e., roasting, grinding and packaging) to increase the revenue positions of their growers instead of supporting imposition of market distorting measures. If value-added activities are embarked upon, increases in expenditures are expected to improve marketing infrastructures.

Both U.S. and rest-of-the-world import demands were price inelastic, but ROW was more inelastic. Any decision to determine which region to increase supplies to will be dependent on the rate of growth in income and the proportional change in quantity demanded given the price and income elasticities. Information and data from previous studies (Maxwell, 1994; Schneider and Gallagher, 1994) have suggested that demand in the U.S. has peaked, therefore any expansion in sales should be targeted toward the EC-12, the former centrally planned economies and Japan. This strategy is supported by the increase in consumption of coffee in Japan and the investment of Japanese companies in some of the coffee producing countries. The results indicate that the U.S. coffee market is more responsive in both prices and income. If the rate of growth of income is faster in the U.S. it may be wise for producers to target the U.S., for increased sales.

The results have shown the inventory is more likely to influence supply decisions during periods of binding export quotas, while fresh coffee stocks impact supply decisions in the non-binding quota periods. The implication is that the ICO may not have been able to impose strict discipline on member exporting countries in terms of releasing supplies in a planned manner on the market.

In summary, expenditures data showed that sales revenues from U.S. importers, to exporting countries were on average 33% and 25% lower during the quota periods. This supports the claim that interference in the market creates inefficiencies that affect both the producers and consumers. This brings into question the effectiveness of exporting quota policies in stabilizing the markets.

Table 12 shows the numerical solution of the reduced form equations using estimates from the models and values of the variables at their means. It indicates that, on average, total quantity exported was 66.06 million bags of coffee and 58.51 million bags in the non-binding and binding quota periods, respectively. U.S. import demand of all coffee was 19.71 million bags and 21.32 million bags, respectively, in the same periods. For the rest-of-the-world, the imported quantities were 46.35 million bags and 37.19 million bags, respectively, in the same periods. The solutions of the reduced form equations indicate that if a 10% shift back in the supply curve was imposed, supplies will decline to 55.89 million bags (i.e., a 10.17 million bags decline) during the non-binding quota period. Supplies will also decline to 56.77 million bags (i.e., by 1.74 million bags) during the quota binding period.

In terms of U.S. import demand for coffee by type, expenditures elasticities were significant for all types of coffee, however, they were elastic for Colombian Mild, Brazil and Other Arabica and Robusta, but inelastic for Other Milds. Significant responses can be seen in the types of coffee consumed in the U.S. as expenditures increase. Consumption of premium coffee (Colombian Mild) in the U.S. market is likely to increase as expenditures on coffee increase. During the last five years two significant changes have taken place in the U.S. These are increases in the proliferation of coffee shops serving specialty coffee, and the number of blended and diversified products that are offered. Of interest to note is that specialty coffees are blended mainly from the premium Arabica coffee, so one would expect an increase in the quantity of premium coffee imported. The instant coffee segment has shown increases in consumption.

Brazil and Other Arabicas, and Robusta are the main types used for blending, and Robusta is used mainly for preparation of instant coffee.

Table 12. Quantities of Coffee Exported and Imported Solved from Pooled Sampled, Split Samples using Estimates and Variables set at their Means.

	Pooled Sample (1964 -1994)	Sample in Non-binding Quota Period (1975 - 1979 and 1987 - 1994)	Sample in Binding Quota Period (1964 - 1974 and 1980 - 1986)
	----- in Million of 60 Kgs Bags-----		
Quantity Exported	61.91	66.06	58.51
Quantity Imported in the U.S.	21.26	19.71	21.32
Quantity Imported By the ROW <sup>a</sup>	40.65	46.35	37.19
Quantity Supplied After a 10% shift in the Supply Curve	53.11	55.89	56.77

<sup>a</sup> ROW means rest-of-the-world.

Consumption of premium coffee (Colombian Mild) in the U.S. market is likely to increase as expenditures on coffee increase. During the last five years two significant changes have taken place in the U.S. These are increases in the proliferation of coffee shops serving specialty coffee, and the number of blended and diversified products that

are offered. Of interest to note is that specialty coffees are blended mainly from the premium Arabica coffee, so one would expect an increase in the quantity of premium coffee imported. The instant coffee segment has shown increases in consumption. Brazil and Other Arabicas, and Robusta are the main types used for blending, and Robusta is used mainly for preparation of instant coffee. The results showed two interesting relationships. Brazil and Other Arabicas, and Robusta are complements during the quota binding period, therefore the ratio of quantities imported are constrained given their uses in blending formulations. However, they are substitutes in the non-binding quota period. Given the preference seen for Robusta, it is very likely that imports of Robusta may increase over imports of Brazil and Other Arabicas.

Own price elasticities were for Other Mild and Robusta. Cross price elasticities were significant for six combinations. These are Colombian Mild and Brazil and Other Arabicas (complements), Colombian Mild and Robusta (complements), Other Milds and Colombian Mild (substitutes), Other Milds and Brazil and Other Arabica (complements), Robusta and Other Milds (complements), and Robusta and Brazil and Other Arabica (substitutes). The results imply that U.S. importers are concerned about the availability of various types to match their blending formulations. This is reinforced by the complementary relationships between Colombian Mild and Brazil and Other Arabicas, and Colombian Mild and Robusta. In addition, this is also supported by the complementary relationships seen between Other Milds and Brazil and Other Arabica, and Other Milds and Robusta. The substitution relationship between Brazil and Other Arabica and Robusta also supports this claim.

In general, the premium Arabicas (Colombian Mild and Other Milds) are complements with lower grade coffees (Brazil and Other Arabicas, and Robusta). These relationships allow for various formulations to be used by roasters and blenders in the importing countries. Importers preferences were seen for Colombian Mild and Robusta. This again supports the aforementioned arguments. The increase in the sale of specialty coffee and instant coffee has impacted the availability of these types of coffee for blending.

There appears to be significant structural changes given the export quota regimes. Structural shifts in the level of imports, prices paid and expenditures on coffee were denoted. The data over the entire period showed that total coffee imports in the U.S. averaged over 21 million bags (bag = 60 kgs) annually. Prices were relatively stable with expenditures averaging just over \$3 billion annually. The increasing trend of specialty marketing of coffee of various flavors (e.g., Starbucks and Barne's) is one possible solution to increasing coffee sales.

CHAPTER 6  
SUMMARY AND CONCLUSIONS

Summary

Several studies have been done with the expressed idea of evaluating the effects of the ICA on the supply and demand for coffee. These studies addressed either supply or demand in isolation of the other. This research attempts to evaluate aggregate export supply and demand for coffee within the framework of the ICA with and without economic provisions. It was further extended to incorporate the import demand in the U.S. (the dominant consumer market) for coffee types. The central questions in this study are what are the impacts of the ICA on export supply and import demand and whether or not the U.S. decision to withdraw from the ICO was based on sound economic logic. The testable hypotheses at both the aggregate and disaggregate levels address the question of structural changes under the ICA with or without economic provisions of the export quota system.

The goal of the study was to assess the impacts of the International Coffee Agreement on the coffee market. In addition, U.S. import demand was examined within the framework of international commercial trade policy. Specifically, the purpose of the research was to assess the behavior of exporters and importers in the coffee market and further to evaluate whether any structural changes in the market occurred under the different trade policy regimes. Due to the nature of the market for coffee, the study

attempts to address these questions within the framework of aggregate export supply, and demand in the U.S. and rest-of-the-world.

Because of the simultaneous relationship in export supply and import demand, a simultaneous model was used at the aggregate level to evaluate the general market. At the disaggregate level a seemingly unrelated regression model was used to assess U.S. import demand by coffee types.

Export supply was examined with the associated variables of spot market price, inventory, total production, a dummy used as a proxy for trade policies, and an interaction term of the dummy and the spot market price. The aggregate demand was decomposed into U.S. demand and the rest-of-the-world. These demands were evaluated with associated variables including spot market price, U.S. per capita disposable income, world per capita gross domestic product as a proxy for world income, prices of tea and coffee. It is the decomposition of U.S. import coffee demand based on coffee types within this framework that set this study apart from other demand studies. The models were estimated as double logs recognizing nonlinearity in the endogenous variables as identified in the aggregate model. In the disaggregate model, conditional U.S. import demand for coffee types was estimated with associated variables including expenditure on coffee as group, prices of different types of coffee and a one period lag for the independent variable used to capture importers preference.

The period of the study covered 1964 to 1994. The major assumptions are that export quotas are relatively inefficient when they are binding, U.S. importers can establish trade preferences even with the imposition of an export quota, coffee is highly

differentiated by type but are close substitutes within a particular group, and that free markets work for coffee producers.

The empirical results showed that market liberalization may be best suited for both the exporting and importing countries of coffee. The results suggest that annual inventory levels and domestic production impact export supply decisions. At the aggregate level, the New York spot market price influences both supply and demand, but both were price inelastic. In addition, income significantly influences both U.S. and rest-of-the-world demands, however both demands are income inelastic, and the global export quota regime influences export supply through its effects on inventory.

In the disaggregate conditional U.S import demand model the following results were noted. Expenditure elasticities were significant for all types of coffee. Colombian Mild, Brazil and Other Arabica and Robusta were elastic and Other Mild was inelastic. Own price elasticities were not statistically significant for any coffee type except for Other Milds and Robusta, however cross price elasticities were significant for the six combinations, where premium and lower grade coffees were complements. Further, importers preferences were seen for Colombian Mild and Robusta. Also, the premium and lower grade coffee types, showed intra-group substitution relationships.

Evidence of structural change was seen in aggregate export supply and demand. At the disaggregate level evidence of structural changes appears to be statistically significant for different coffee types given the export quota regimes.

Conclusions

Other researchers (Bohman et. al 1996, Bohman and Jarvis, 1996) have suggested that the export coffee market faces two prices, a high price for the members of the ICO and discounted prices for non-members of the ICO. In fact, this has caused exhaustive rent seeking activities in the industry at the value-added level. It is plausible to state that the global quota must be considered as a supply shock variable. However, it appears that the ICA has consistently supported a dual pricing system for exported coffee. This is illustrated in figure 4. In the short run, a binding export quota causes an adjustment in the price of coffee from equilibrium  $P^*$  to  $P_s$  with quantities contracting from  $Q^*$  to  $Q_q$ . In the long-run, prices are likely to fall to  $P_L$  where exporters are operating on the elastic portion of the supply curve. This is what the data in the market place suggest with the evidence of exporters facing a dual pricing scheme for coffee.

It can be concluded that the ICO should support liberalizing the market for coffee. One way is to dismantle commodity boards and involve more of the private sector in providing the facilitating functions that are required for the marketing of coffee. However, these marketing entities may be required to support establishing a price stabilizing fund to ensure that prices do not reach depressing levels in the exporting countries when coffee prices are depressed overseas. One way to finance this, which is different from a quota system, would be to develop a coffee check-off program.

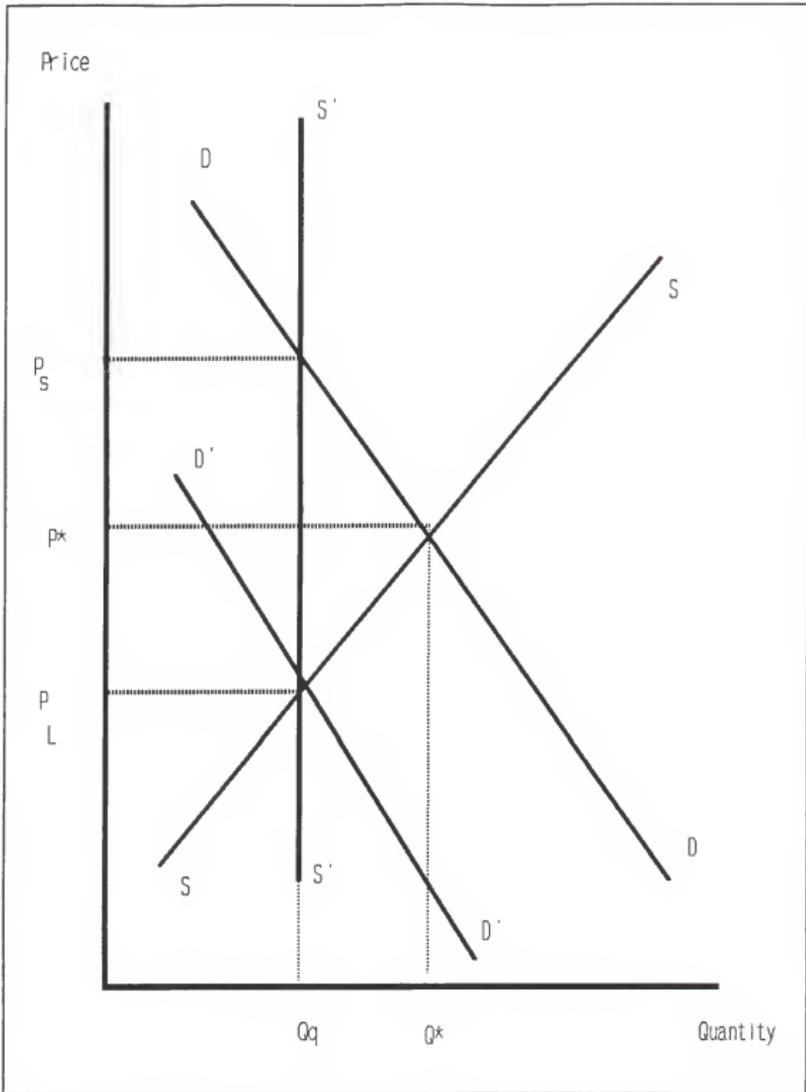


Figure 4. Dual Pricing for Exported Coffee

In addition, some of this funding could be used for promotion, market development and sponsored research to highlight favorable attributes of coffee. More value-added operations should be encouraged in the producing countries as supported by the result that shows the influence of carry over stocks and total production on export supply decisions. These activities would include the roasting, blending and packaging of coffee. This will require improvement in the current marketing infrastructure. This has already begun in some countries supported by investors from Japan.

On the U.S. demand side, the results yielded evidence of structural change, implying differences in the coffee market given the export quota policy regime. It is suspected that binding export quotas result in structural change. This runs counter to the U.S. free market position and therefore supports its withdrawal from the ICO on the basis that the export quota system results in losses to both consumers' and producers' welfare. It appears that after 18 years of the export quota, U.S. importers may have designed ways to cope, through adjustments in blending formulation, stockpiling and by consolidation, reducing the number of roasters in the U.S. market. This could explain the high prices for coffee at the retail level. The U.S. may be justified in its decision to withdraw from the ICO given the directly unproductive activities (DUP) through rent seeking activities in the industry as result of the ICA.

#### Suggests for Further Research

The model provided insights into the aggregate export supply and import demand for coffee. In addition, the decomposed model provided results on U.S. import demand based on coffee types. The proposed hypotheses were tested and yielded results that

were consistent with expectations. However, further research is needed to develop a more comprehensive picture of the world's coffee market based on coffee type. Suggested approaches for further research should include the development of a world model for supply and decomposing the effects of the dominant producers and consumers by coffee type. Real welfare effects could be evaluated by doing this. From a policy point of view, that approach would be quite useful to determine the production pattern that would be ideal for various coffee types. In addition, more research is needed on the role of inventory (if data is available by country) in export supply decisions.

Another area of research that could be useful is the application of an industrial organization framework to evaluate market margins, mark-ups, the structure, conduct and performance of the major importers in different importing countries including the U.S., and to assess their impact on coffee demand. In addition, research is needed to evaluate the real effect of the ICA on consumer's welfare. Most useful to policy makers would be the development of a strategic trade policy framework with simulations of global quotas and non-quota trading to assess the impact of the export quota policy under the ACPC's new coffee export retention scheme.

## REFERENCES

- Adams, F. G. and J. R. Behrman. (1976). Econometric Models of World Agricultural Commodity Markets: Cocoa, Coffee, Tea, Wool, Cotton, Sugar, Wheat, and Rice. Ballinger Publishing Company. Cambridge, Massachusetts.
- Akiyama, T. and R. C. Duncan. (1982). Analysis of the World Coffee Market. The World Bank. Washington, D.C.
- Akiyama, T. and P. N. Varangis. (1989). Impact of the International Coffee Agreements Export Quota System on the World's Coffee Market. International Commodity Markets Division, International Economics Department. World Bank. Washington, D.C.
- Andrews, M. C. (1992). Avenues for Growth: A 20-Year Review of the U.S. Specialty Coffee Market. Specialty Coffee Association. Long Beach, CA.
- Bacha, E. L. (1968). An Econometric Model for the World Coffee Market: The Impact of Brazilian Price Policy. Ph.D Dissertation. Yale University. Connecticut.
- Bain, J.S. (1942). "Market Classification in Modern Price Theory." Quarterly Journal of Economics. 56: 560-574.
- Bohman, M., L. Jarvis and R. Barichello. (1996). "Rent Seeking and International Commodity Agreement: The Case of Coffee." Economic Development and Cultural Change. 44:279-404.
- Bohman, M. and L. Jarvis (1996). "The International Coffee Agreement: A Tax on Coffee Producers and Consumers." Working Paper Series #96-2. University of British of Columbia, Vancouver, B.C.
- Bread for the World. (1990). Exploring Linkages: Coffee. Institute on Hunger and Development. Silver Springs, Maryland.
- Brillembourg, A. (1975). Specification Bias in the Demand for Imports: The Case of Gran Colombian Countries (Colombia, Ecuador and Venezuela). International Monetary Fund. World Bank. Washington, D.C.

- Coffee Exports Suspended (1995) Caribbean Update 11: 1.
- Clarke, R.J. and R. Macrae. (1988). Coffee Volume 6: Commercial and Technico-Legal Aspects. Elsevier Science Publishers LTD. Essex, England.
- Clodius, R.L. and W.F. Mueller. (1961). "Market Structure Analysis as an Orientation for Research in Agricultural Economics Research." Journal of Farm Economics. 43:315-533.
- Cochrane, W.W. (1957). "The Market as a Unit of Inquiry in Agricultural Economics Research." Journal of Farm Economics. 39: 21-39.
- Daly, F. R. (1958). "Coffee Consumption and Prices in the United States." Agricultural Economic Research Report #10 United States Department of Agriculture. Washington, D.C.
- Deaton, A. S. and J. Muellbauer. (1980). Economics and Consumer Behavior. Cambridge University Press, London, England.
- Dull, R. E. T.(1992). Coffee International Development Horticultural and Tropical Products Division. Foreign Agricultural Service. United States Department of Agriculture. Washington, D.C.
- Dull, R. E. T. (1994). Tropical Products: World Markets and Trade. Foreign Agricultural Service. United States Department of Agriculture. Washington, D.C.
- Eaton, J. and G. Grossman. (1986). "Optimal Trade and Industrial Policy Under Oligopoly." Quarterly Journal of Economics. 101: 382-405.
- Economic Report of the President (1996). The Annual Report of the Council of Economic Advisers. Bernan, Lanham, Maryland.
- Fisher, F.M. (1976). The Identification Problem in Econometric. Krieger Publishing Company, Hunting, New York.
- Ford, D. J. (1977). Coffee Supply, Trade, and Demand: An Econometric Analysis of the World Market, 1930-1969. Ph.D Dissertation. University of Pennsylvania. Union Park, Pennsylvania.
- Gallant, A. R. (1987). Nonlinear Statistical Models. John Wiley and Sons. New York, New York.
- Geer, T. (1971). An Oligopoly: The World Coffee Economy and Stabilization Schemes. New York Duerellen Publishing Company, Inc. New York.

- Golstein, M. and M. S. Khan (1985). Income and Price Effects in Foreign Trade. in R. W. Jones and P. B. Kenen (eds.). Handbook of International Economics Vol. II. Elsevier Science Publisher. B.V. Amsterdam, Holland.
- Gray, F. D. (1971). "The Demand Trend in the United States Coffee Consumption." Economic Research Service #138 United States Department of Agriculture. Washington, D.C.
- Greene, W. H. (1990). Econometric Analysis. Macmillian Publishing Company. New York, NY
- Hall, B. H., C. Cummins and R. Schnake. (1995). Time Series Processor Version 4.3 User Guide. TSP International. Palo Alto, CA.
- Hausman, J.A. (1978). "Specification Tests in Econometrics." Econometrica.46(6):1251-1271.
- Helpman, E. and P. Krugman (1989) Trade Policy and Market Structure. MIT Press. Cambridge, MA.
- Hyuha, T. S. (1982). "World Demand For Coffee: With Particular Reference to East Africa". Economic Research Bureau. University of Dar-es-salaam. Tanzania, Africa.
- International Monetary Fund. (1988). Primary Commodities: Market Development and Outlook. Research Department. World Bank. Washington, D.C. 53-55.
- Intalianer, A. and G. d'Alacantara. (1986). Modeling Bilateral Sector Trade Flows. in P. Artus and F. Gagly (eds.). International Macroeconomic Modeling for Policy Decisions. Marinus Nijhoff Publisher. Dordrecht, Holland.
- International Trade Center (UNCTAD/GATT). (1992). Coffee: An Exporter's Guide. International Trade Center. Geneva.
- Iovasy, G. (1967). Development of U.S. Coffee Consumption: Analysis and Forecast. World Bank. Washington, D.C.
- Karp, L. S. and J. M. Perloff. (1993). "A Dynamic Model of Oligopoly in the Coffee Export Market." American Journal of Agricultural Economics 75: 448-457.
- Kohli, U. (1991). Technology, Duality and Foreign Trade. Simon and Schuster International Group. London, UK.
- Krause, W. (1965). International Economics. Houghton Mufflin Company. Boston, MA.

- Kreinin, M. E. and E. Dinopoulos. (1992). "Alternative Quota and VER Allocation Scheme: A Welfare Comparison." Econometrica. 59: 337-49.
- LaFrance, J.T. (1991). "When Is Expenditure Exogenous in Separable Demand Models." Western Journal of Agricultural Economics. 16(1): 49-62.
- Langham, M. R. and F. Kamajou. (1992). "Pricing Policy in the Cameroon Coffee Sub-Sector with Emphasis on Arabica: Producers Returns Versus Government Revenues." Proceedings of Agricultural Policy Analysis in Sub-Saharan Africa, University of Florida, Gainesville, Florida.
- Lanzillotti, R. F. (1960) "The Superior Market Power of Food Processing and Agricultural Supply Firms: Its Relation to the Farm Problem." Journal of Farm Economics. 42: 1228-1247.
- Layman, Thomas A. (1979). The Economics of Export Controls-With an Empirical Application to the Brazilian Coffee Industry. Ph.D Dissertation, University of North Carolina at Chapel Hill, North Carolina.
- McCabe, J. P. (1992). Users, International Tea and Coffee Directory and Buyer's Guide. Tea and Coffee Journal. New York.
- Manzella, J. L. (1994). Mexico and NAFTA: The Real Impact. Journal of Commerce of New York City, New York.
- Manzella, J. L. (1995). "No More Business As Usual: Economic Integration is Changing the Landscape of International Trade." Sky Magazine. 24: 118 - 128.
- Maxwell, Jr., J. C. (1994). The Maxwell Consumer Report. Wheat First Securities, Inc. Butcher and Singer, New York.
- National Coffee Association of U.S.A., Inc. (1993). United States of America: Coffee Drinking Study Winter 1993. National Coffee Association of U.S.A., New York.
- Parikh, A. (1973). "United States, European and World Demand Functions for Coffee." American Journal of Agricultural Economics. 55: 490-494.
- Pollock, G. E. (1971). An Analysis of the Price and Production Effects of the 1963-68 International Coffee Agreement. Ph.D Dissertation, The Ohio State University, Lafayette, Ohio.
- Prebish, R. (1963). Towards A Dynamic Development Policy For Latin America. United Nations, New York.

- Schneider, G. J. and J. M. Gallagher. (1994). Industry and Trade Summary: Coffee and Tea. United States International Trade Commission. Washington, D.C.
- Shelton, R. M. (1976). Fluctuation and Growth of Latin American Export Proceeds: The Case of Brazil. Ph.D Dissertation, University of Miami at Miami, Florida.
- Smith, R. S. (1974). Diversification Alternatives and Inducement in the Colombian Industry. Ph.D Dissertation, University of Texas at Austin, Austin Texas, 1974.
- Stigler, G. J. (1964). "A Theory of Oligopoly." Journal of Political Economy. 72: 44-46.
- Timms, D. E. (1973). World Demand Prospects for Coffee in 1980 with Emphasis on Trade for Less Developed Countries. Foreign Agricultural Economic Report #86. United States Government Printing Office, Washington, D.C.
- Tweeten, L. (1992). Agricultural Trade: Principle and Policies. Westview Press, Boulder, CO.
- Urban F. and R. Nightingale. (1993). "World Population by Country and Region, 1950-90 and Projection to 2050." Staff Report # AGES 9306, Agriculture and Trade Analysis, Economic Research Service, United States Department of Agriculture. Washington, D.C.
- United States Department of Agriculture. (1994). "Tropical Products: World Markets and Trade." Foreign Agricultural Services, FTRPO 4-94, Washington, D.C.
- United States Department of Commerce, Business and Service Administration. (1961). Coffee Consumption in the United States, 1920-1965. United States Department of Commerce. Washington, D.C.
- United States Department of Commerce (1987). Census of Manufacturers. Government Printing Office. Washington, D.C.
- Vanderslice, Jr. E. L. (1971). The International Coffee Organization and the Control of Coffee Over-Production. Ph.D Dissertation, University of Michigan, Ann Arbor, Michigan.
- Vogelvang, E. (1992). "Hypothesis Testing Concerning Relationships Between Spot Prices of Various Types of Coffee." Journal of Applied Econometrics. 7: 191-201.

Vogt, D. U. (1990). "International Coffee Agreement: A Status Report." Congressional Research Service Report for Congress, Washington, D.C.

World Bank Data (1995). World Bank Indicators. World Bank, Washington, D.C.

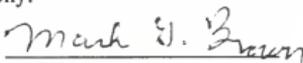
## BIOGRAPHICAL SKETCH

Samuel W. Scott was born on January 17, 1956, in Charlestown, St. Mary, Jamaica, West Indies to Aubrey and Myrtle Scott. In 1973, he graduated from Ferncourt High School, St. Ann. He enrolled at the Jamaica School of Agriculture in 1974. He graduated in 1977 with an Associateship in Science in agriculture with honors. After working for two years in extension and rural sector credit, he entered the University of the West Indies at the St. Augustine campus in Trinidad. He obtained a Bachelor of Science degree in 1981 with honors in agriculture majoring in agricultural economics. In 1989 he enrolled at the University of Florida and was awarded a Master of Science (MS) in food and resource economics in 1991. After a brief period of consultancy he continued studying toward the doctor of philosophy (Ph.D) in food and resource economics beginning in January, 1992. Beginning the summer of 1992, he took leave of absence for 15 months to provide technical assistance on a federal program in the Lower Mississippi Delta Region. Since then he has provided technical assistance in economic development in nine states in the Mid-South and Southeastern U.S. In addition, he has provided consultancies overseas in project management and evaluation, international trade and marketing. In fall of 1993 he returned and, after sharing time between consultancies and study, he was awarded the Ph.D in 1996 with specializations in international trade and marketing, and agribusiness. He is married to Marcia Marie. They have two children, Sadeeka and Samae.

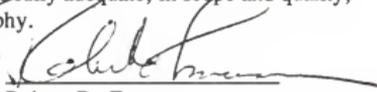
I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree Doctor of Philosophy.

  
John J. VanSickle, Chair  
Professor of Food and  
Resource Economics

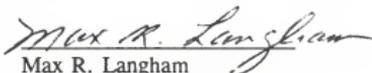
I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree Doctor of Philosophy.

  
Mark G. Brown  
Professor of Food and  
Resource Economics

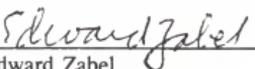
I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree Doctor of Philosophy.

  
Robert D. Emerson  
Professor of Food and  
Resource Economics

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree Doctor of Philosophy.

  
Max R. Langham  
Professor of Food and  
Resource Economics

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree Doctor of Philosophy.



Edward Zabel  
Professor of Economics

This dissertation was submitted to the Graduate Faculty of the College of Agriculture and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

December 1996



Dean, College of Agriculture

\_\_\_\_\_  
Dean, Graduate School